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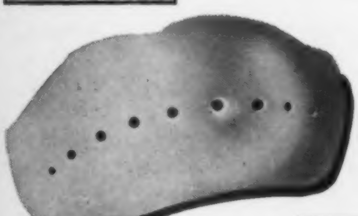

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American Journal
of
ORTHODONTICS

VOL. 41 SEPTEMBER, 1955 No. 9

Original Articles

PRESIDENT'S ADDRESS, AMERICAN ASSOCIATION OF ORTHODONTISTS

FREDERICK T. WEST, D.D.S., SAN FRANCISCO, CALIF.

IT IS my sincere pleasure to welcome you to San Francisco to participate in the fifty-first session of the American Association of Orthodontists.

My commission at this moment is not from the orthodontists of San Francisco, but from the orthodontists of the Pacific Coast—actually, from the members of the Pacific Coast Society of Orthodontists.

This meeting was conceived and planned by all of us, and we feel honored in being selected by you to be your hosts.

Our one regret is that San Francisco does not possess a hotel of sufficient magnitude to allow for the housing of our entire membership, but we hope that you will bear with us in this deficiency.

The traditional presidential address may take on several forms. It can be a dry, statistical résumé of cold facts and figures of organization and committee activity. It can take the form of a critical review of the organization, with suggestions for elaborate reforms and changes which are often superficially conceived and at times in poor taste. It can assume the character of a pseudophilosophy, with words and words and more words.

We shall try to avoid boring you. We shall try to report some pertinent information. We shall try to express our gratitude to all who have labored long and diligently. We shall try to be explicit in our statements and, most of all, we shall try to take less than the allotted thirty minutes.

Presented before the annual meeting of the American Association of Orthodontists, San Francisco, California, May 9, 1955.

My first expression of gratitude is to you, my fellow orthodontists, who saw fit to entrust the production of this annual session to your confreres on the Pacific Coast.

In the fifty-four years of our existence and in the fifty-one sessions of our organization, you have been to the Pacific Coast but twice before—once in an adjourned meeting with the Panama Pacific Exposition in San Francisco in 1915 and once in Hollywood in 1938. It is our sincere wish that we might be visited more often.

Upon our return from St. Louis, we looked ahead three years and thought that our meeting was far, far away. We planned leisurely and thoroughly and the selection of the general chairman and the program chairman for the meeting was the easiest job that a president has ever had.

Reuben L. Blake, an experienced committee chairman of the San Francisco District Dental Society, the California State Dental Association, the American Dental Association, and the Pacific Coast Society of Orthodontists, graciously accepted the appointment as general chairman and from that point until today your president has never had a single worry as to the success of the mechanics of this meeting.

George W. Hahn, essayist, clinician, organizer, and indefatigable worker in every dental and orthodontic organization of which he is a member, enthusiastically accepted the appointment as program chairman for the meeting, and, as I reported to you in Chicago, his program was complete at that time except for two spots that he intentionally left open until after the 1954 meeting. I am sure that the program that he has prepared for you is outstanding in its array of talent; it is because of a reciprocal feeling of admiration and appreciation that the essayists responded to his invitation.

It was his idea to have the Round Table Luncheon and the limited attendance clinics. The stature of the clinicians is such that any or all of the participants could be headliners in any orthodontic meeting.

We cannot leave these thoughts without presenting the name of Richard M. Railsback, who worked with George Hahn as clinic chairman, and who has done an outstanding job. My appreciation is extended also to Ernest L. Johnson (as treasurer of the Local Arrangements Committee, his headaches are about to start); to Raymond M. Curtner, chairman of registration, who is a stickler for detail; to Robert Whitney, chairman for the press; to Glenn W. Foor, chairman of exhibits; to Susan Locke Lindsay and Mrs. Reuben L. Blake, chairmen for the ladies' entertainment; to John Parker, chairman of the photographic tour; to Arthur F. Skaife and Lloyd Chapman, cochairmen for the Monday night Get Acquainted Dinner; to J. Kester Diment, chairman for equipment, an exacting and detailed job that few appreciate, and to his assistant Rodney Johnson, who was in charge of signs; to Arnold E. Stoller and Glendon H. Terwilliger, cochairmen of the Round Table Luncheon; to William S. Smith, chairman of the president's reception and banquet; and to Richard E. Cline, Walter J. Straub, and Walter J. Furie, cochairmen of the Reception Committee.

My heartfelt thanks to more than 100 members of the Pacific Coast Society of Orthodontists who wear a "committee" badge, a symbol of service, to be of assistance to you in any way possible. Ask them any question or make any request; they will be happy to assist you and make your stay pleasant and happy. The registration desk will be happy also to give you any information you require. Please use this service.

Words fail to express my thoughts of gratitude to the twenty-two major essayists and the eight limited attendance clinicians, to the thirty round table discussion leaders, and to the fifty general clinic participants. Without these untiring, unselfish, enthusiastic confreres and hundreds of others like them, we would be a static organization, a defunct profession devoid of progress.

As for the Board of Directors and the chairmen of elected and appointed committees, seventy-eight in number, I pause to acknowledge their loyalty and sacrifices. While you and I enjoy ourselves, renew old friendships, meet and make new friends, attend the scientific and clinical programs, these men, more than 100 in number, are busily engaged in discussing, arguing, planning a better profession for you and me. To these men I extend our grateful thanks. I include the Ladies' Entertainment Committee in these remarks and hasten to add that a total of more than 290 participants made this meeting possible.

Three outstanding activities that continue year after year, without interruption and without fanfare, demand a special word of appreciation.

The American Board of Orthodontics, composed of seven of our outstanding members, devotes untold hours to the reading and evaluating of theses submitted by applicants for certification; a tremendous responsibility rests upon their shoulders. They come to the annual session one week ahead of you and me and review the cases presented by the selected applicants; they interview each applicant, compile their several evaluations, and decide if the applicant is worthy of certification. Truly, this is a service of love for their profession; it is a responsibility akin to that of any examining board. We salute them.

We pause to congratulate Joseph E. Johnson, this year's recipient of the Albert H. Ketcham Memorial Award.

The Publication and Editorial Board of our Association, with Leigh Fairbank as chairman, is another year-round activity. The editor, H. C. Pollock, one of our outstanding workers, has been around more years than he would care to admit. He is one of our "old timers," but he is one of our most youthful, most active, most enthusiastic, and most dependable officers and committeemen. Our JOURNAL is scientific; it is published monthly; it is controlled entirely in its editorial policy by our representative, our editor; the advertisements are in absolute accord with the regulations concerning advertising as outlined by the American Dental Association. There are many and diverse problems that confront Editor Pollock. The publication of material, the number of illustrations, the time of publication, and the position of the articles are but a few of the editorial problems that he has.

Our Local Arrangements Committee wishes to publicly thank our editor for the outstanding publicity he gave to this San Francisco meeting. His is an outstanding contribution.

The Research Committee deserves our sincere thanks for the tremendous amount of time devoted to the reading and classifying of the essays submitted for consideration of the $500.00 prize offered by our Association. Research is not a popular subject, but it is a necessary subject; without it we would cease to be a profession.

I am not trying to detract from the splendid program to be presented this afternoon in this room, but I do urge you to slip away quietly for a brief spell of a half-hour or so and listen to the reports of the young men and some older ones, too, who are striving to tell us the "why" of many things.

Jack Salzmann and his committee are to be congratulated on their enthusiasm and their patience in trying to encourage further studies that you and I might approach our professional problems more scientifically and logically.

Your president would like to present a special bouquet of profuse thanks to G. Vernon Fisk, chairman of the Necrology Committee, an appointed committee and one that requires the patience of a Job. It is perfectly true that all one should need to do is to have certain key persons send in an obituary each time one of our members dies so that adequate records might be kept and an official announcement made in our publications. However, it just is not that simple. It requires constant vigilance, tenacious adherence to routine correspondence, infinite patience, and a generous disposition adequately to administer the duties of this committee.

G. Vernon Fisk has set up a plan and has accomplished a goal during this past year that has set an example for those who are to follow. We sincerely thank him.

Please do not think that I am unmindful of the untiring efforts of George H. Siersma, chairman of Budget, Leigh C. Fairbank, chairman of the Publication and Editorial Board, Frank P. Boyer, chairman of Public Relations, Wendell L. Wylie, chairman of Education, Oren A. Oliver, chairman of Constitution and By-Laws, Wilson R. Flint, chairman of Convention Planning, J. A. Salzmann, chairman of Public Health, Malcolm R. Chipman, chairman of Relief, John R. McCoy, chairman of Laws and Infractions, D. Robert Swinehart, chairman of Military Affairs, William A. Giblin, chairman of the Judicial Council, Gerald Franklin, chairman of Inter-Relations, James D. McCoy, chairman of Nomenclature, and Charles R. Baker, chairman of the Golden Anniversary Luncheon. I am very thankful to them and their committee members, but time does not permit a roll call of all of those who have contributed to the success of our organization.

It was my pleasure as president during the past year to be the guest of three Constituent Societies—the Northeastern Society, the Great Lakes Society, and the Southern Society.

I can report to you that the type of program presented by these three societies was so outstanding that it dispelled any thought of decadence of

spirit, if I ever allowed such a thought to pass through my mind. There were outstanding essayists in each group. The meetings were conducted in a manner that showed alertness, and interest in the welfare of the organization was a crowning feature. I regret that I was unable to visit more of our confreres, but the time would not permit.

Yesterday morning at the Board of Directors' meeting, it was my pleasure to report to that group my observations concerning the office of secretary-treasurer of our Association and the physical equipment for handling the office routine.

For fifty-four years some kind soul who had a liking for detail accepted the office of secretary-treasurer. We have grown from a handful of members to our present number of 1,492 in 1955, and yet no one has ever given much thought as to how the office was run, where the secretary pursued his duties, or how much time it took him to discharge his responsibilities. Like Topsy, we just grew.

Ladies and gentlemen, for years we have imposed upon the time, energies, and good nature of our secretary-treasurers, and have saddled a financial burden on every one of them.

Franklin A. Squires needs no introduction to you, nor praise from me. He is a modest, meticulous, serious-minded person who loves association work and who has, as have all our past secretaries, suffered a terrific financial loss on his time and a physical fatigue on his body. I will say nothing of the encroachment on the time that should belong to his family.

On my visit to the Northeastern Society meeting I visited our secretary-treasurer at his office. He has a beautifully appointed office with elbow room to spare, but he certainly does not have sufficient space for his official office of secretary-treasurer and so he has moved the equipment to his home.

At his home, we sat in a room that was once his study—a room of about 10 by 12 feet—but which is now filled with our secretarial equipment, files, and whatnot.

What I am trying to say to you is that a reorganization of the office of secretary-treasurer must take place; sufficient money must be appropriated to rent suitable office space and to employ adequate clerical help.

I do not believe that we need a change in our By-Laws; merely Board action, plus budgetary approval, for the proper balance of the material, financial, and professional activities of the office should be sufficient.

Unless one has had experience in doing secretarial work for an organization, it is impossible to realize the tremendous amount of detail and correspondence that is routinely encountered.

This recommendation from your president is urgent; a special committee from the Board of Directors is studying the matter and a report is expected from them at tomorrow's meeting of the Board of Directors.

A second recommendation is the authorization of the appointment of a special committee to study and report to the Board of Directors a plan for the proper method of handling the transfer of a patient from one orthodontist to another, from one part of the country to the other.

This is a most embarrassing situation at times, but there must be some equitable manner in solving this problem.

I appreciate the right of individual interpretation of diagnostic material, the right of selection of the various accepted philosophies of treatment, the human equation of cooperation and response of patients, and last, but not least, the fact that some of us do have failures and it does seem coincidental that these failures sometimes move to a distant city. But in spite of all these handicaps, we should have a logical analysis of the case that we are correcting, and we should be able to submit a treatment record if our patient should be compelled to move from one locality to another.

I know that at least two constituent societies are working on such a problem, and I am sure that a strong committee could be organized to study and report effectively a method of caring for transfer patients who would be better cared for than they are at the present time.

We have been extended a special privilege by our various states to practice our profession. We have a responsibility to our patients, to our profession, and to ourselves. We must practice the highest possible standards to justify that privilege.

My attention has been called by George M. Anderson to the fact that on June 1, 1855, just 100 years ago, Dr. Edward H. Angle, the first president of our Association was born. It was not my privilege to know Dr. Angle, but through valued association with many colleagues who studied under him, I have learned to revere the name of the man who has given so much to our profession. I am quite familiar with many of the shortcomings of the great men of orthodontics of yesterday and today, but as the eyes close only the constructive thoughts, the good deeds, and the progress one has made should be remembered.

I recommend that suitable resolutions by this Association memorializing Dr. Edward H. Angle on his centennial be authorized and be sent to his surviving widow as a token of our appreciation of our first president.

Tomorrow morning, at 11:15 A.M., the first business meeting of our Association will be called to order.

A very important amendment of our by-laws, defining the requirements of applicants for election to membership, will be voted upon. These requirements were read at our last annual session. You have all received a copy of the amendment through the mail, as required by our by-laws.

Oral discussions have been numerous throughout the year and printed observations have been available for your study as published in the AMERICAN JOURNAL OF ORTHODONTICS. Your mind should be made up by now.

I urge every member of this Association to be present tomorrow morning and to vote as his conscience directs him to vote.

To Franklin A. Squires, our secretary-treasurer, my sincere thanks for an outstanding job in his most exacting office. Words fail to express my appreciation for all that he has done for us. I know of no one who has

impressed me more than he, even though it has been my pleasure to know him for only a few years. He is tireless, exacting, and patient. He is the perfect secretary.

To my fellow officers—Philip E. Adams, president-elect and parlimentarian, George H. Herbert, vice-president, Charles R. Baker, librarian, and Leuman M. Waugh, historian—my sincere thanks for their wholehearted cooperation.

My thanks to the gentlemen who supply our commercial needs, and who are exhibiting their products at this meeting. We hope that you will visit with them.

And my sincere thanks to all of you who have traveled great distances to be with us at this session. We have tried to produce an outstanding meeting, and we hope that you will approve.

I hope that I have conveyed my appreciation to you for the high honor you have bestowed upon the Pacific Coast, upon San Francisco, and upon me.

Addressing you has been the most proud moment of my professional career. I will never forget it.

760 MARKET ST.

THE RATES OF GROWTH OF SEVERAL FACIAL COMPONENTS MEASURED FROM SERIAL CEPHALOMETRIC ROENTGENOGRAMS

RAM SARUP NANDA, B.D.S., PH.D., F.I.C.D., DENVER, COLO.

THE importance of a knowledge of the growth and development of the human face for sound diagnosis and treatment of dentofacial disharmonies has been widely recognized. In the last thirty years there have been a number of investigations[1-5] which depicted the patterns of facial development as revealed by anthropometric measurements of growing children. With the standardization of the more precise technique of cephalometric roentgenography,[6, 7] a fresh impetus was received for the study of growth of the dentofacial complex. In almost all the preceding investigations[8-11] from the cephalometric roentgenograms, the growth of the face has been studied by superposing the head tracings on some one of the anthropometric planes, which has been regarded as fixed. Since there is no landmark in the human head that is truly stationary, the information obtained from such comparisons of the tracings is only limited to changes relative to the plane chosen. The contributions of this procedure have been many; yet, to overcome the limitations involved, it seemed necessary to apply other methods of studying changes in the form of the face. Of other methods available, the one of quantitative analyses by estimating the relative rate of growth proved most profitable.

PRESENT STUDY

Data.—The present investigation utilizes serial cephalometric roentgenograms of fifteen white persons—ten males and five females. All the individuals were participating in the longitudinal growth study at the Child Research Council. The program and the nature of records being maintained at the Child Research Council have been adequately discussed by Waldo,[12] McDowell,[9] and Washburn.[13] The present study covers an age range of 4 to 20 years. Only lateral head roentgenograms were used. For each subject, a minimum of twelve to a maximum of seventeen roentgenograms were available. The roentgenograms were usually, but not always, taken every year up to the time of puberty and every two years thereafter.

From the Child Research Council and the University of Colorado School of Medicine.

Supported in part by grants from the Commonwealth Fund, the Grant Foundation, and the Rockefeller Foundation.

Read before the fifty-first annual meeting of the American Association of Orthodontists, San Francisco, California, May 10, 1955.

Based on the thesis submitted to the faculty of Medicine, University of Colorado, in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department for the Study of Human Growth. The complete thesis will appear in the 1955 issue of the *Ergebnisse der Anatomie und Entwicklungsgeschichte.*

Method of Analysis.—Seven linear dimensions were measured on the roentgenograms taken in norma lateralis. The dimensions were chosen so as to represent the outline and configuration of the total face. The purpose was to point out the over-all growth changes in the various dimensions of the face. The measurements were taken directly on the roentgenograms with a centimeter ruler graduated up to .05 cm. Before measuring, the bony points were located in the periphery of the face, as shown in Fig. 1. The landmarks and the mode in which they were located are as follows:

Nasion (*NA*): The most forward mid-point of the frontonasal suture.

Sella (*SE*): Center of sella turcica.

Prosthion (*PR*): The lowest point of the alveolar bone between the maxillary central incisors.

Fig. 1.—A typical cephalometric roentgenogram taken at the Child Research Council and the position of anthropometric points considered in the present study.

Infradentale (*ID*): The point of the alveolar bone between the mandibular central incisors.

(Each of these four points was located by inspection of the roentgenogram.)

Gnathion (*GN*): The point on the chin determined by bisecting the angle formed by the facial and mandibular planes.

Gonion (*GO*): The point on the gonial angle determined by bisecting the angle formed between the mandibular plane and the plane representing the posterior border of the ramus of the mandible.

The measurements taken on each roentgenogram of a series were sella-nasion, nasion-gnathion, nasion-prosthion, nasion-infradentale, sella-gonion, gonion-gnathion, and sella-gnathion. To check the error of measurement, 110 measurements were repeated after an interval of several months. The maximum error observed was plus or minus .05 cm. In most instances (64 per cent), the repeat figures agreed with the original measurements.

In some roentgenograms the shadows of the right and the left halves of the mandible were not coinciding, which may have been due either to the degree of asymmetry of the child's head or to defect in the positioning of the head in the cephalostat. Regardless of what the cause of this factor was, it was decided for the purposes of this study to take a midline of the two shadows and locate the points, gnathion and gonion, on this midline. In addition, the error due to enlargement in the roentgenograms was found to be .04 cm. for every 1 cm. of length. This distortion was considered minimal and, since it was manifested uniformly in all the roentgenograms, no correction was found necessary.

Rate of Growth.—From the original measurements taken at intervals of one to two years for each of the dimensions, the values at every six-month interval were interpolated. The data collected in this manner were analyzed by both the basic curves of growth and the curves of relative rate of growth. Relative or percentage increments were computed for every six months, using the following formula: $\dfrac{Y_2 - Y_1}{\dfrac{Y_1 + Y_2}{2}} \times 100$, where Y_1 and Y_2 are the values at the beginning and the end of the time period, respectively. The percentage rates of growth thus obtained were three-point smoothed twice by applying the technique of Boyd[14] (see Fig. 4) to show the basic trend, which was obscured by excessive fluctuations.

The relative increments were plotted against age at the mid-point of the time interval, since these increments represent the average relative rate of growth over the entire interval. For example, the relative rate of growth for six months for the time period between 13 years, 6 months and 14 years was plotted at age 13 years, 9 months.

FINDINGS

In Fig. 2 are shown the curves of growth of the measurements of the seven dimensions for one boy, No. 62, formed by plotting them against ages 4 to 22 years. Each one of these curves possesses the general basic characteristics common to many parts of the human body, including all those of the skeleton except the cranium. They have an almost straight-line rise from 4 to about 12 years, but actually a shallow curve with decreasing slope except the temporary dips in nasion-prosthion and infradentale-gnathion at the age of about 6 to 8 years, then a short, rapid rise followed by a gradual leveling off. The upper two curves—those for sella-gnathion and nasion-gnathion—are the most like other skeletal growth curves. Sella-gonion and gonion-gnathion start at the same magnitude, but the former rises rapidly for about a year and then slows

off, while the latter maintains a more uniform rate so that they meet again by 8 years, run approximately together until about 14 years, and then are widely separated by the greater circumpuberal spurt of sella-gonion. In contrast to the foregoing, the curve of growth for sella-nasion slows off more markedly after the age of 6 years than the previous ones and has a barely perceptible circumpuberal spurt. The curve for sella-nasion appears to be a composite of the patterns of both neural and skeletal growth, which perhaps would be expected since sella-nasion is a common dimension between the cranium and the face.

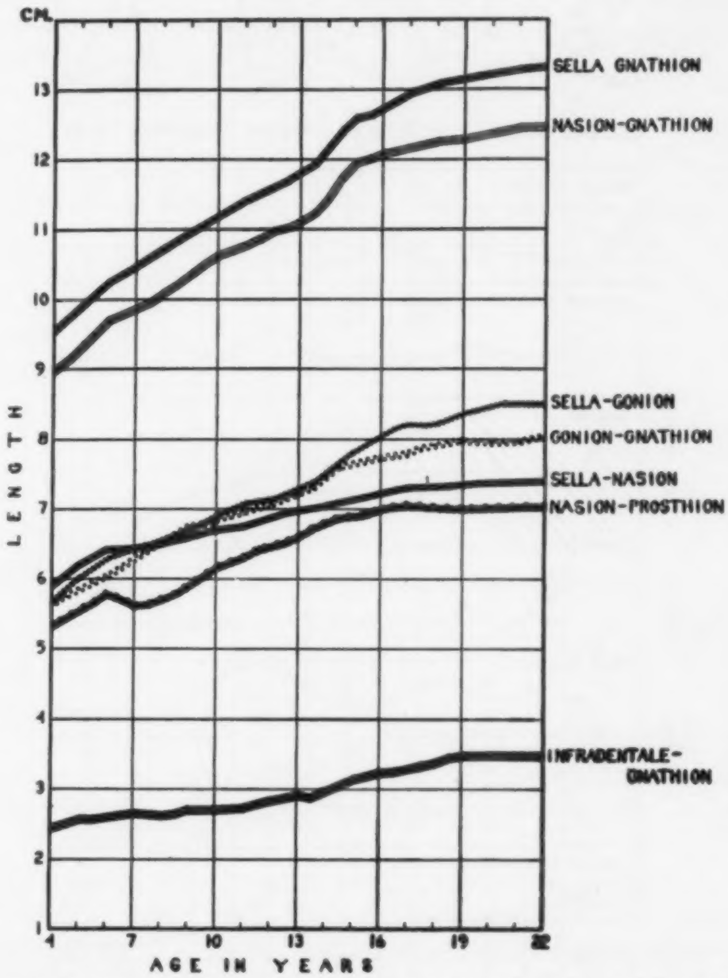

Fig. 2.—Growth curves of facial dimensions of Child Research Council boy No. 62.

The nasion-prosthion shows a temporary decrease in size which is readily accounted for by the loss of deciduous teeth and the accompanying resorption of alveolar bone. The emergence of permanent teeth and re-formation of alveolar bone quickly restores this decrease in size. The slight lag in infradentale-gnathion from 7 to 8 years reflects a similar process in the mandible, as will be shown by the more sensitive method of relative increments.

Fig. 3 shows the percentage increment curves for the seven facial dimensions of the same boy, No. 62. The diagrams in the upper portion of Fig. 3 indicate facial polygons constructed from these seven linear dimensions. The polygons have been reduced uniformly to compare the proportional size at the approximate ages of 5, 10, 15, and 20 years. Since the growth curves have the basic character of a skeletal growth curve, the relative increment curves would be expected to have the same general pattern of rapidly decreasing slope interrupted by a

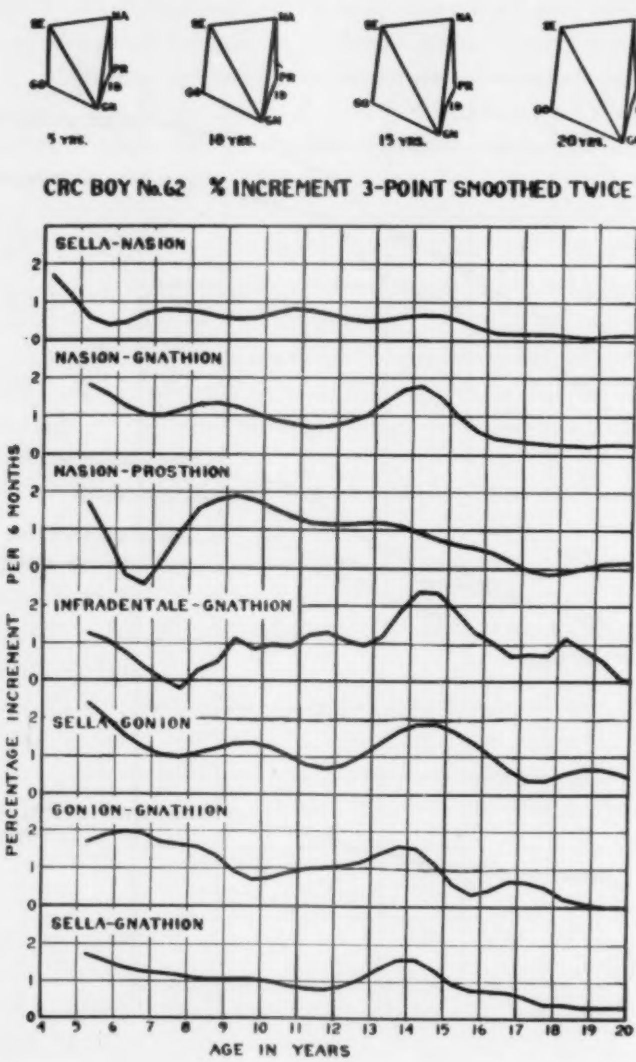

Fig. 3.

major circumpuberal maximum, as illustrated for body height in Fig. 4. This pattern is true with some striking exceptions due to local differences in facial growth. One of the marked differences is the occurrence of secondary maximums that were seen often before and sometimes after the circumpuberal growth cycle. The postpuberal maximums have been seen by Boyd[15] in her analysis

of the lateral growth as measured by shoulder, chest, and hip widths. It appears that these are in reality part of the patterns of growth and not artifacts. Among the prepuberal maximums, the ones seen in nasion-prosthion and infradentale-gnathion portray the process of recovery in the size of these dimensions following the decrease resulting from resorption of alveolar processes due to shedding of teeth. The prepuberal maximums in the other dimensions were seen rather consistently, although the time of their occurrence varied from as early as 7 years in sella-nasion to as late as 11 years in gonion-gnathion. In the latter dimension, the prepuberal maximum is not very marked. Unlike the other dimensions that have only one prepuberal maximum, sella-nasion in this boy shows a second minor maximum at about the age of 11 years. The

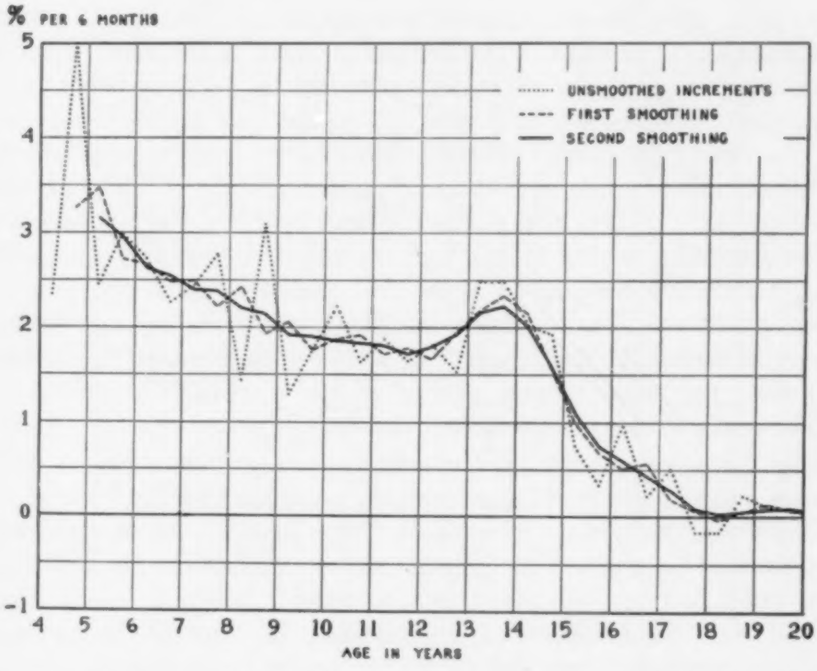

Fig. 4.—The effect of two applications of three-point smoothing of the relative increment curve for the body height of Child Research Council boy No. 62. (From the unpublished study of Boyd.[14])

prepuberal maximums also have been noticed by Boyd[14] in many of the anthropometric dimensions of the body, but she is not sure as yet to what extent they represent experimental error instead of real phenomena of growth. My impressions in relation to this phenomena will be stated during consideration of the group patterns.

The lag in infradentale-gnathion, which could hardly be seen in Fig. 2, is quite readily observed in Fig. 3, where the amount of decrease is expressed relative to the magnitude of the dimension. Since these processes of sudden decrease and equally rapid restoration in the size of nasion-prosthion and infradentale-gnathion are real phenomena which are peculiar only to these two

dimensions, and also because this subject will require special consideration in relation to the development and emergence of teeth, it was decided to limit the discussion on the growth of these two dimensions to only one boy—No. 62.

The increment curves for sella-gonion and gonion-gnathion predominantly show the growth in the height of the ramus and the length of the body of the mandible, respectively. Keeping this in mind and comparing the relative increment curves of these dimensions in Fig. 3, one will notice that gonion-gnathion increases at a greater rate than sella-gonion between the ages of 6 and 9 years. This greater increase in the length of the body of the mandible is probably to accommodate the additional teeth in the dental arch, that is, the first and second permanent molars. Between the ages of 13 and 16 years, however, sella-gonion shows a greater proportionate increase than gonion-gnathion; and, while gonion-gnathion has stopped growing by 19 years, sella-gonion continues to increase. The timing of these differences in the growth pattern is suggestive of an adaptation phenomenon. In addition, it will be seen that, for the boy under discussion, all except two dimensions are growing even at the age of 20 years. The two dimensions that have ceased to show increments are infradentale-gnathion and gonion-gnathion. This indicated that growth of the face of this boy was not complete at the age of 20 years, even though he stopped growing in his body height at the age of about 18 years (Fig. 4). Of the five dimensions of the face that show some degree of increase at the age of 20 years, sella-gonion has the largest relative increment. This observation of the pattern of growth in sella-gonion is quite significant, since it agrees with the usual clinical finding of the increasing prominence of the mandibular angle in the postadolescent child.

In Fig. 5 are shown the curves of relative rate of growth for six dimensions in ten boys and five girls. The individuals are arranged in order of the time of circumpuberal maximum in general body height. These maximums are drawn in vertical lines across each set of curves. The circumpuberal maximums for each dimension are indicated by an arrow. The six linear dimensions represented were sella-nasion, nasion-gnathion, sella-gonion, gonion-gnathion, sella-gnathion, and total body height, which have been designated in the figures by *A, B, C, D, E,* and *F*, respectively. The numerical figures for each set of curves denote the Child Research Council serial number for the individual.

The curves for both sexes have the same general patterns, but, as would be expected, the girls have their circumpuberal spurt earlier. It will be observed that the findings from Figs. 2 and 3, about boy No. 62, are generally applicable to the whole group. It is evident from the relative increment curves of the fifteen subjects portrayed that all the curves start off with a decelerating trend. This trend, in some instances, is interrupted between the ages of 5 and 10 years by small secondary maximums. During adolescence, all the increment curves show a circumpuberal maximum which is followed by a process of gradual decrease in the rate of growth until the increments approach zero. It is apparent from a comparison of the curves of body height and those for facial dimensions that the increments of the latter reach zero later than the former.

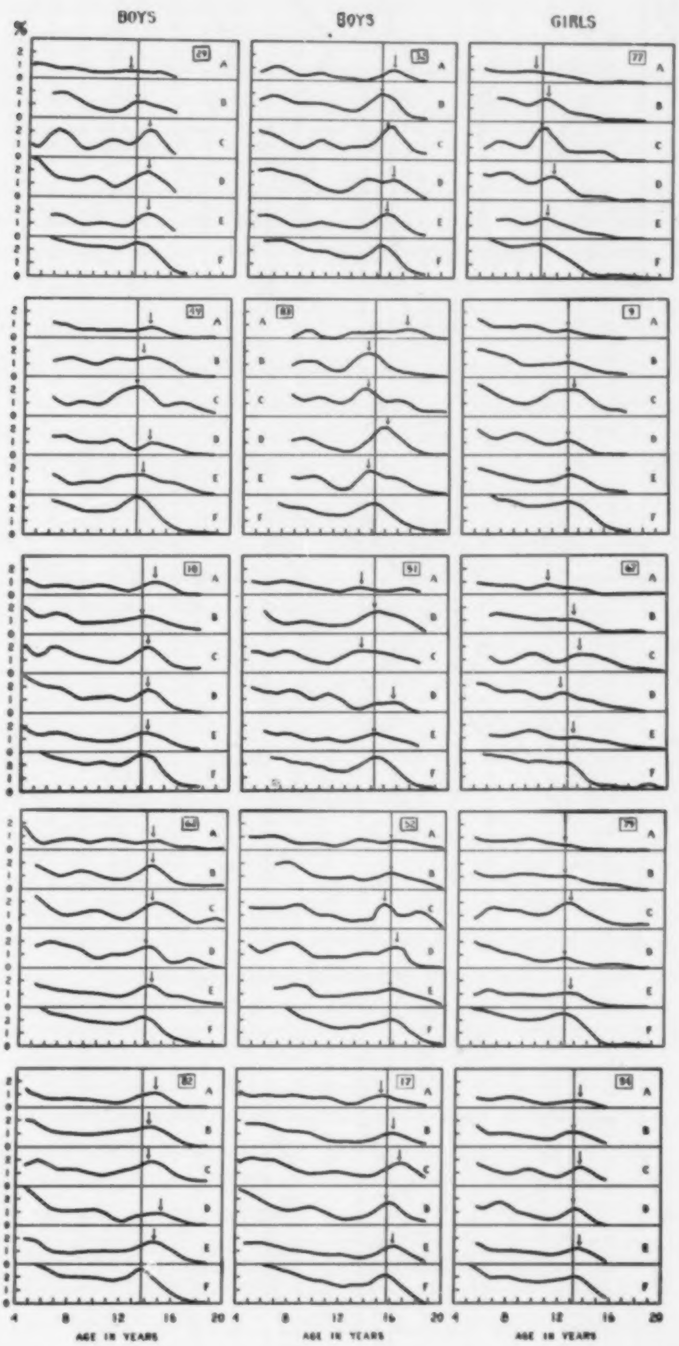

Fig. 5.—Curves of relative rate of growth for five facial dimensions and body height for each of the fifteen individuals studied. Vertical lines across each set of curves represent the age of circumpuberal maximum in body height. Arrows indicate the age of circumpuberal maximum for the particular dimension. *A*, Sella-nasion; *B*, nasion-gnathion; *C*, sella-gonion; *D*, gonion-gnathion; *E*, sella-gnathion; *F*, body height.

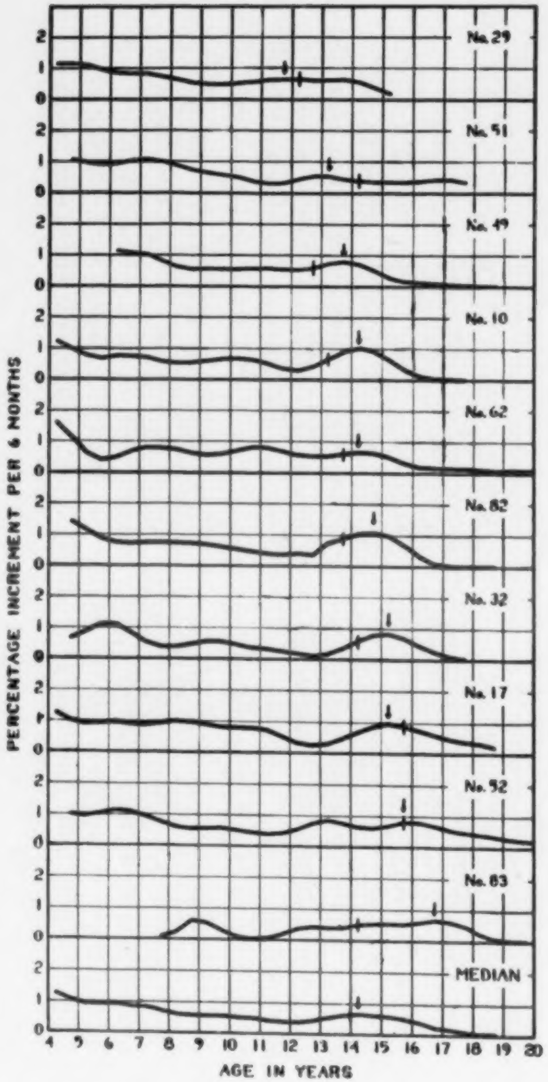

Fig. 6.

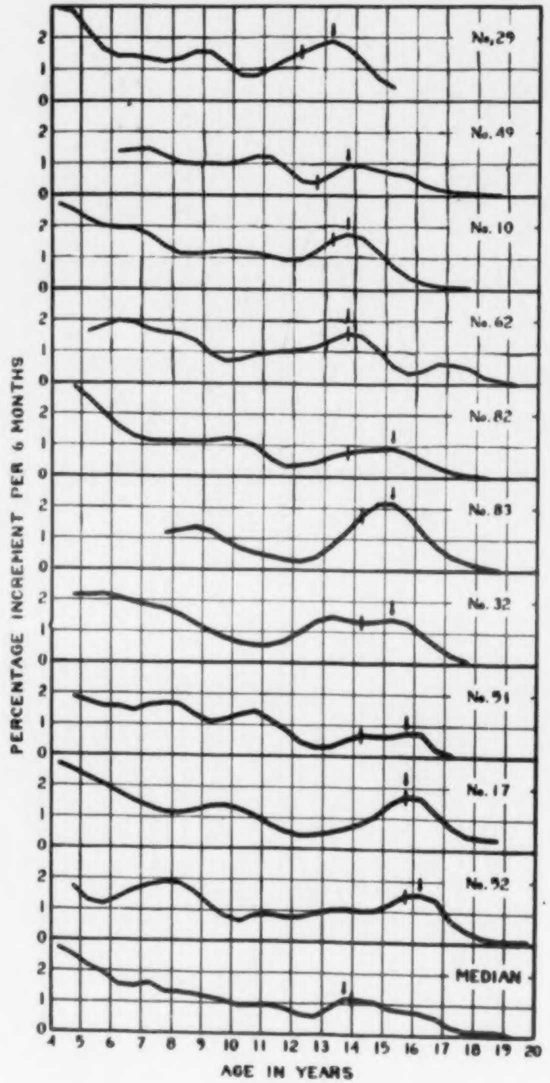

Fig. 7.

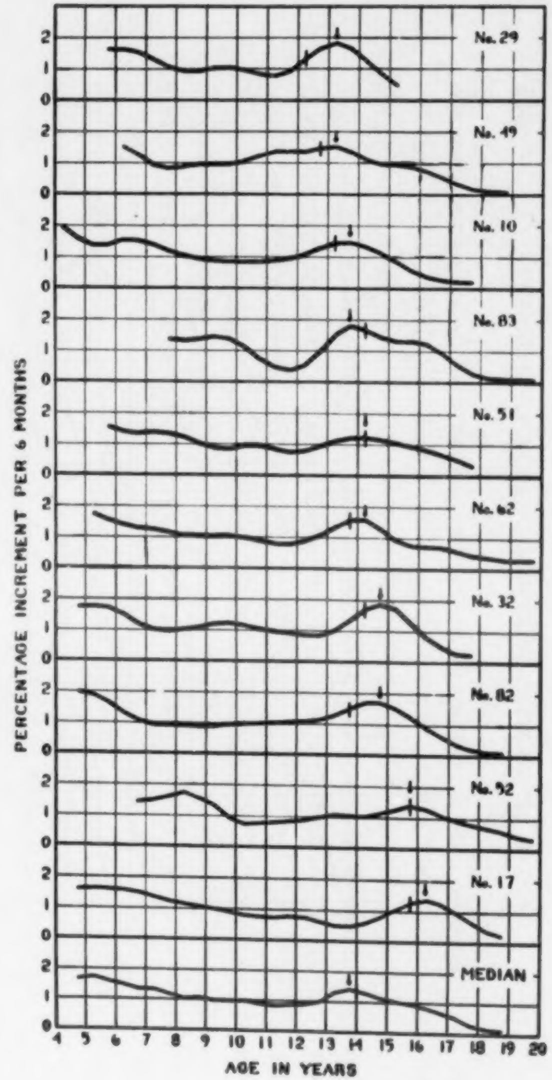

Fig. 8.

Fig. 6.—Percentage increment curves of ten Child Research Council boys (sella-nasion).
Fig. 7.—Percentage increment curves of ten Child Research Council boys (gonion-gnathion).
Fig. 8.—Percentage increment curves of ten Child Research Council boys (sella-gnathion).

It will be noticed also that the circumpuberal maximums in height and the facial dimensions generally occur close to each other. On the whole, the circumpuberal maximums in the facial dimensions have a tendency to occur slightly later than in body height. In terms of actual figures, there were, in all, seventy-five increment curves. The circumpuberal maximums for twenty-one (28.0 per cent) were the same as that of body height; for forty-three (57.3 per cent) they were six months or more later; and for eleven (14.7 per cent), earlier.

It also appeared from the study of Fig. 5 that the duration and magnitude of the circumpuberal growth vary with the individual and that the character of the linear dimension varies even in the same individual. The age at which each individual reaches the adult size depends on his or her own pattern of physical growth and maturation. Again, the rate of growth of the face of an individual is also variable. For example, in the case of boy No. 51, the increment curves of both face and height reached the circumpuberal maximum in a relatively quick and short spurt, but afterward the rate of growth decreased slowly and steadily to approach 0 per cent. This is in contrast to boy No. 32, for whom the cycle of adolescent growth was relatively short. Such differences are seen in varying degrees among the subjects studied.

The secondary maximums were found to occur quite commonly. They were seen more in childhood than in the postadolescent period. The consistency with which the prepuberal maximums occur suggests that they may be due to an actual temporary growth acceleration. More investigation will have to be done to learn the nature of such episodes.

Figs. 6, 7, 8, 9, and 10 represent each of the dimensions of sella-nasion, gonion-gnathion, sella-gnathion, nasion-gnathion, and sella-gonion, respectively, for the ten boys. The increment curves are arranged in the order of increasing age at which the circumpuberal maximums occur on the increment curve of a dimension. The small vertical lines drawn across the curves indicate the time of circumpuberal maximums of the body height of that individual, while the arrow stands for the time of circumpuberal maximum of the increment curve under discussion. The last curve at the foot of each of the figures is the median increment curve for the ten boys. The time of circumpuberal maximum of all dimensions is markedly skewed so that the spread between the late-maturing ones is greater than between the early-maturing ones. Hence, a curve based on summation of these curves cannot be considered as typical for any individual, but only as the median of the group.

These figures for the five dimensions have been arranged in order of the increasing magnitude of the circumpuberal maximums of their median increment curve, which ranged from 0.75 per cent for sella-nasion to 1.75 per cent for sella-gonion. The position of the boys with respect to their rank for each of the dimensions was found to be pretty consistent; that is, if a boy, say No. 29, was relatively early maturing with regard to sella-nasion, he was found to be early maturing in the other dimensions, too. But this was not true in all the cases and, to illustrate it, two boys, Nos. 32 and 83, will be considered. Boy

No. 32 has essentially the same position in the group throughout in all dimensions, but boy No. 83 has three dimensions—sella-gnathion, nasion-gnathion, and sella-gonion—in the fourth or the fifth place, while gonion-gnathion and sella-nasion have the sixth and the tenth places, respectively.

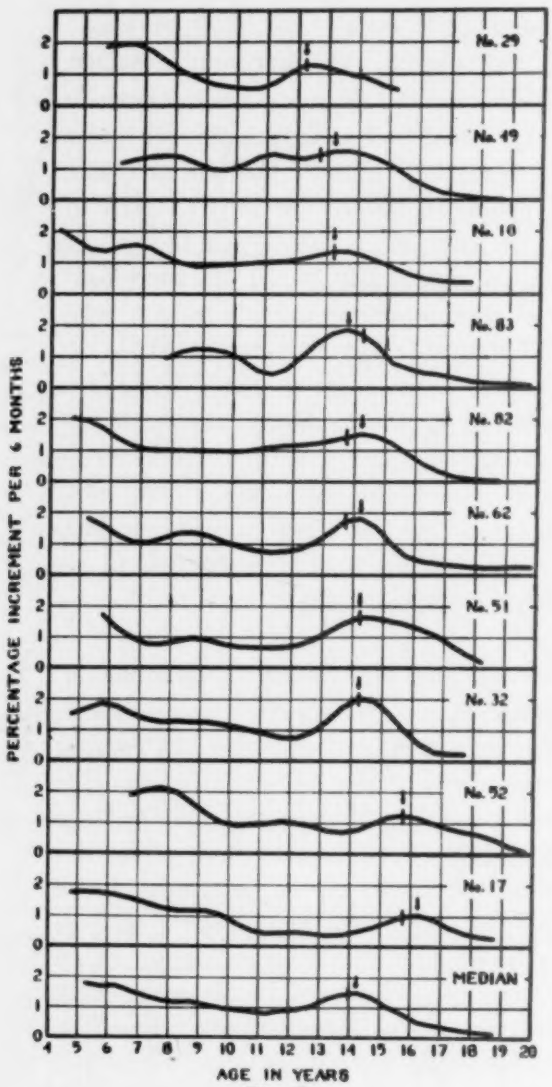

Fig. 9.

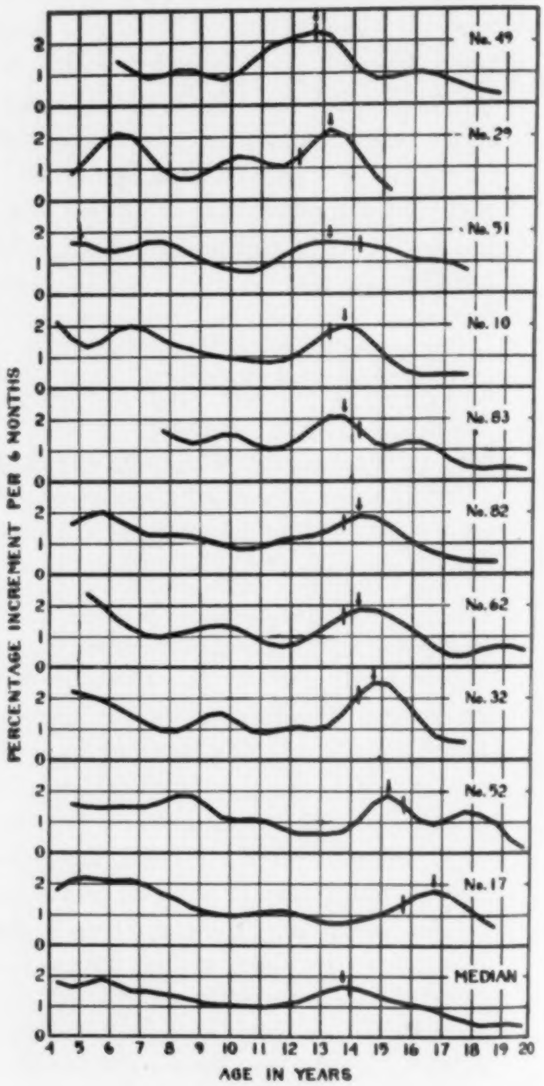

Fig. 10.

Fig. 9.—Percentage increment curves of ten Child Research Council boys (nasion-gnathion).

Fig. 10.—Percentage increment curves of ten Child Research Council boys (sella-gonion).

In order to compare and understand the differences between the patterns of facial growth of these two boys, their curves were plotted in a broken line for boy No. 83 and a dotted line for No. 32, against the curves for the eight others in solid light lines, as shown in Fig. 11. These drawings show that these two boys had a tendency to maintain their position relative to the group at all

ages, even though some intertwining of the growth curves was noticeable during the period of adolescence. For example, boy No. 32 had relatively small facial lengths at the age of 4 years, the size of which remained relatively small even at the age of 19 years. As a result, he had an all-around small face. On the other hand, boy No. 83 has relatively large lengths for nasion-gnathion and sella-gnathion, but he has relatively small-sized sella-nasion and gonion-gnathion. Sella-gonion for this boy is, however, the largest in the group. It would appear, then, that this boy (No. 83) has a very long face which is proportionately small in depth. Since his bigger dimensions stayed big and the smaller ones remained small, he would have the same kind of facial configuration as compared to others throughout the period of growth. From this, it would appear that facial configuration is established early in life and that, once established, it does not change. But this is not quite true, because there are smaller changes accompanying the growth of the face which differentiate the physiognomy of

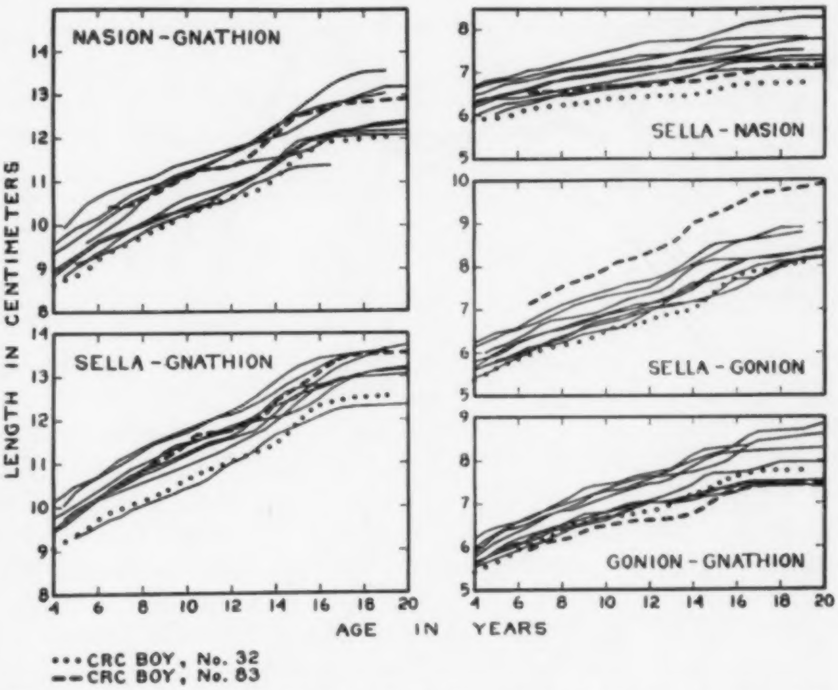

Fig. 11.—Comparison of absolute dimensions of two boys in a group of ten.

an individual during the period of growth. These finer changes in the proportion of the various dimensions of the face were clearly apparent from the study of the percentage increments of growth. Such changes can be seen more readily by superpositioning of the curves of percentage increment for all the dimensions of these boys, as shown in Fig. 12. Such a method of superposition also permits easy comprehension and comparison of the rates of growth of various dimensions according to age. For example, it will be seen from the increment curves of boy No. 32 that gonion-gnathion grows at a greater relative rate between the ages of 5 and 9 years than the other lengths; but during

adolescence sella-gonion shows a greater relative increase and continues to lead and is still growing at the rate of over 0.5 per cent when all the other dimensions have almost stopped growing. Also, the circumpuberal maximums on the increment curves of this boy occurred more or less concomitantly within a two-year period. This regularity in the pattern of growth of this boy is consistent

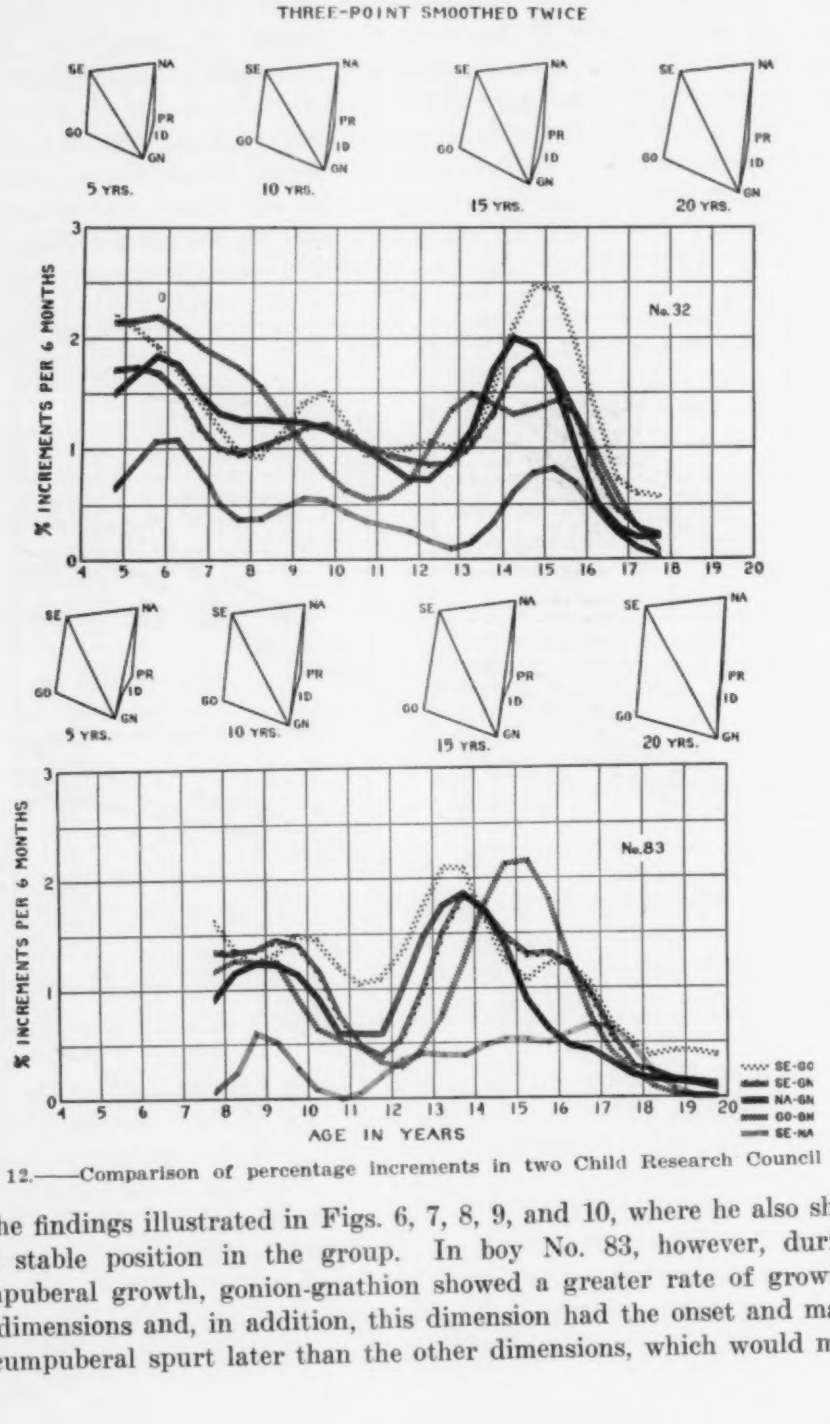

Fig. 12.——Comparison of percentage increments in two Child Research Council boys.

with the findings illustrated in Figs. 6, 7, 8, 9, and 10, where he also showed a rather stable position in the group. In boy No. 83, however, during the circumpuberal growth, gonion-gnathion showed a greater rate of growth than other dimensions and, in addition, this dimension had the onset and maximum of circumpuberal spurt later than the other dimensions, which would make his

profile less prognathic. In this boy, as in the other, between the ages of 17 and 18 years the sella-gonion had a greater rate of growth than the rest of the dimensions. Unlike boy No. 32, the circumpuberal maximums did not occur concomitantly and were scattered over a period of four years, those of sella-gonion, sella-gnathion, and nasion-gnathion being about eighteen months ahead of those for gonion-gnathion and sella-nasion. This irregularity in his pattern has already been demonstrated by tracing his position in Figs. 6, 7, 8, 9, and 10.

To learn more about the circumpuberal growth, individual percentage gains between the ages of 10 and 17 years were determined for each dimension. By the age of 10 years, all the individuals in the present study were still preadolescent, while at 17 years all of them had completed the major part of their circumpuberal growth cycle. Of the five dimensions, the sella-gonion had the greatest and the sella-nasion the smallest percentage gain. This was found to be true for all the individual cases in both sexes except one boy, No. 52, in whom gonion-gnathion, and not sella-gonion, had the biggest gain in length. The percentage gains in the other three dimensions varied in rank.

TABLE I. SEX DIFFERENCES IN THE GROWTH OF FACIAL DIMENSIONS BASED ON INDIVIDUAL PERCENTAGE GAINS FROM 10 TO 17 YEARS OF AGE FOR TEN BOYS AND FIVE GIRLS

DIMENSION	BOYS			GIRLS			DIFFERENCE OF MEANS	P
	MINIMUM	MEAN	MAXIMUM	MINIMUM	MEAN	MAXIMUM		
Se-Na	5.22	7.31	9.17	3.82	4.18	5.02	3.13	>.001
Go-Gn	10.29	14.08	16.71	6.27	8.52	12.48	5.55	>.001
Na-Gn	9.14	14.69	17.66	8.50	9.80	10.80	4.89	>.01
Se-Gn	12.31	15.58	18.26	8.81	10.88	12.75	4.70	>.001
Se-Go	15.13	18.68	22.85	10.91	15.74	20.88	2.94	>.10

In order to determine whether there was any valid sex difference in the amount of percentage gain between the ages of 10 and 17 years, the significance of the differences between the mean percentage gains of each dimension were tested by the application of Student's "t" test. The results obtained from this test are summarized in Table I. The probability values in the case of all dimensions were significant except for sella-gonion, where the sex difference was not significant. It should be remembered, however, that sella-gonion had the biggest percentage gain and that the magnitude of this gain was large relative to the other dimensions in both the sexes. In large samples, this difference might well prove significant.

Sex differences in the mean lengths of the facial dimensions at the ages of 10 and 17 years were also studied. Student's "t" test was applied to the differences of the mean in a similar manner and the results are shown in Table

TABLE II. SEX DIFFERENCES IN MEAN LENGTH IN CENTIMETERS OF THE FACIAL DIMENSIONS BEFORE AND AFTER ADOLESCENCE

DIMENSION	MEAN AT 10 YEARS		DIFFERENCE	P	MEAN AT 17 YEARS		DIFFERENCE	P
	10 BOYS	5 GIRLS			10 BOYS	5 GIRLS		
Se-Na	6.90	6.52	0.38	>.05	7.40	6.79	0.62	>.01
Go-Gn	6.93	6.73	0.20	>.40	7.91	7.30	0.61	>.05
Se-Go	7.00	6.36	0.64	>.02	8.31	7.35	0.96	>.01
Na-Gn	10.80	10.54	0.25	>.40	12.38	11.57	0.81	>.05
Se-Gn	11.24	10.78	0.46	>.20	12.99	11.95	1.04	>.001

II. By the usual statistical interpretation, only sella-nasion and sella-gonion are significantly larger in boys than in girls at 10 years of age, and all five dimensions are so at 17 years. This indicates that the magnitude of growth is greater in boys than in girls.

SUMMARY AND CONCLUSIONS

The present investigation deals with the analysis of the growth patterns of the human face as studied from serial lateral cephalometric roentgenograms of fifteen persons. Each series of roentgenograms was studied in terms of both curve of growth and curve of relative increment. The results of this investigation are:

1. The growth curves of all the facial dimensions were typical of general skeletal growth curves other than cranium, which has a neural type of growth. The curve for sella-nasion is a composite of neural and general body growth. Those of nasion-prosthion and infradentale-gnathion are modified in childhood by the successive processes of shedding of deciduous teeth and emergence of permanent teeth.

2. Analysis by the relative increment curves not only emphasizes, but also sharpens, the differences in the growth curves. While there is a general circumpuberal rise, the time of both the onset and the peak of the rate of growth are different for the various dimensions of the same child. Since all dimensions do not grow at the same relative rate, the form of the face is, of necessity, changed.

3. The differential rates of growth in gonion-gnathion and sella-gonion during childhood and adolescence were interpreted to be suggestive of an adaptational phenomenon.

4. When the growth curves of an average and an extreme case are plotted with the growth curves of the total group, it becomes apparent that the various dimensions keep their relative position the same in the group between the ages of 4 and 20 years, even though the same boy can have some dimensions that are relatively long, while others are relatively short. Nevertheless, when the finer analysis by means of relative rates is made, the differential rates of growth are sufficient from one dimension to another to change the form of the face over and beyond the basic age change in facial form common to all persons.

5. Both the growth curves and the relative increment curves show that the growth of the face tends to have its circumpuberal maximum slightly later than that for the general body height. Also, body height completes its growth sooner than the face.

6. In the small sample of boys and girls studied at the Child Research Council, the girls show relatively less facial growth than the boys during adolescence.

7. The present study illustrates the need for more careful quantitative analyses, especially of relative rates of growth of the facial dimensions on the same persons over the total development period which probably extends well

into the twenties. The orthodontist who constantly works with the mechanisms underlying the growth of the face needs to adapt his methods of treatment to fit with and take advantage of these basic growth patterns.

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THE NEWBURGH-KINGSTON CARIES FLUORINE STUDY
IX. DENTOFACIAL GROWTH AND DEVELOPMENT—CEPHALOMETRIC STUDY

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PURPOSE OF THIS STUDY

THIS study was undertaken to determine the nature and extent of the difference, if any, in the dentofacial growth and development between children in Newburgh, New York, a city where the central water supply is fluoridated to bring its fluoride content up to 1.0 to 1.2 parts per million parts of water, and the comparable city of Kingston, New York, where the water supply is fluoride-deficient.

INTRODUCTION

Studies conducted in the United States and elsewhere have established the fact that the addition of controlled amounts of the fluoride ion to drinking water is an important method of substantially reducing dental caries in children.[1-4]

Inquiry into the status of water fluoridation in the United States today shows that more than 1,000 communities with a combined population of over 20 million, now add a fluoride compound to their drinking water supplies. In addition, more than 3 million persons are consuming fluoride-containing water to the extent of 0.9 or more ppm fluoride found naturally in their water supplies. One out of every four persons in the United States who live in communities with a central water supply is now drinking water which has been fluoridated to the optimum level.[5]

Ast,[6] in 1943, suggested fluoridation of community water supplies to test the effectiveness of the caries fluorine hypothesis. In 1944 the initial examinations of the Newburgh-Kingston Caries Flourine Study were started to establish a base line. On May 2, 1945, Newburgh's water supply was treated with sodium fluoride to bring its fluoride content up to the desired level of 1.0 to 1.2 ppm. This concentration has been continuously maintained. Kingston's water supply which had a fluoride concentration of approximately 0.1 ppm, was not altered.

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After a period of approximately nine years of fluoride experience in Newburgh, this study continues to show cumulative evidence that the use of fluoridated water by children during the formative period of their teeth is associated with a reduction of caries experience of up to 60 to 65 per cent. In addition, the loss of permanent first molars, which has been shown by Salzmann[7] to be associated with an increase in the prevalence of malocclusion when not attended by orthodontic intervention, has been reduced. In the Newburgh-Kingston groups studied, 6.7 per cent of all the first permanent molars of the Kingston 9- and 10-year-old children had been already extracted, whereas not a single first permanent molar was missing in the Newburgh group.[2]

STATEMENT OF THE PROBLEM

Fluoridation of central water supplies has received the endorsement of practically all accredited dental, medical, and public health agencies, as well as the American Association for the Advancement of Science. Widely conducted studies on the effects of drinking fluoridated water on systemic health reveal no deleterious sequelae.[8]

A growth and development study made by Schlesinger and his co-workers[9] of children in Newburgh, New York, who had been drinking fluoridated water for almost seven years showed no significant differences from children of the control area. Skeletal growth and maturation were found to be neither accelerated nor retarded.

Investigations by Flory[10] and others furnish standards for assessing skeletal development and maturation by the inspection of roentgenograms of the hand. Todd[12] found roentgenograms of the hand to provide the most reliable single index of skeletal maturation.

McCauley and McClure[14] published a report on the effects of fluoride in drinking water on the osseous development of the hand and wrist in children at Amarillo and Lubbock, Texas, where the water supply contains 3.5 to 6.2 ppm fluoride, compared with children in Cumberland, Maryland, where the drinking water contains less than 0.1 ppm fluoride. They used Todd's index to assess skeletal age and the Carter[13] method for establishing skeletal development. In the summary of their findings they state the following:

> No evidence, available by radiographs, was obtained which would indicate that there was any adverse effect on the carpal bones or on their growth and development as a consequence of the continuous use of drinking water containing approximately 3.5 to 6.2 ppm F. These results confirm the safety of maintaining the fluoride level of public water supplies at about 1.0 ppm F., by controlled fluoridation, for the reduction of tooth decay.

While these and other studies can be accepted to indicate no difference in skeletal maturation, there were no data available on the effects of ingested water fluorides on dentofacial growth and development of children.

It was deemed advisable, therefore, to obtain quantitative and qualitative data on dentofacial growth and development of children who consume drinking water to which controlled amounts of the fluoride ion have been added.

OUTLINE OF STUDY

A preliminary report on the plan of the Newburgh-Kingston dentofacial growth and development study has been published previously by Ast.[15] In summary, the plan of the study includes, among other correlations, consideration of the following:

1. Cephalometric determinations, here presented and others to follow.
2. Malocclusion—quantitative and qualitative analysis.
3. Dental arch formation.
   a. Arch character—wide, median, narrow.
   b. Intercanine width
   c. Intermolar width
   d. Median line length
4. Tooth size and cusp height.
5. Tooth calcification and eruption.

MATERIALS

The sample of children chosen for this study was determined by the availability of x-ray facilities in the public schools of Newburgh and Kingston. From previous data[2] on DMF rates (average number of decayed, missing, or filled teeth) per child by schools in the respective cities, it was determined that the school selected in Kingston had a caries rate which was among the lowest in that city, while the DMF rates in Newburgh were comparable with the range of DMF rates for that entire city. This selection appears to favor the control city of Kingston, as it had the effect of minimizing the difference in the DMF rates between the two cities, thus lessening any differences in dentofacial growth and development that might be attributed to the DMF factor.

TABLE I. NUMBER OF CHILDREN ON WHOM CEPHALOMETRIC X-RAY MEASUREMENTS WERE OBTAINED BY AGE OF CHILD, NEWBURGH AND KINGSTON, NEW YORK

AGE AT LAST BIRTHDAY (YEARS)	NEWBURGH	KINGSTON	TOTAL
6	73	114	187
7	98	71	169
8	80	88	168
9	74	58	132
10	61	42	103
Total	386	373	759

This study includes 386 children, aged 6 through 10 years, in Newburgh and 373 children of the same age level in Kingston, for a total of 759 children (Table I).

METHODS

Cephalostatic profile roentgenograms on 8 by 10 inch x-ray films were obtained of the children just mentioned. Since angular measurements in cephalometrics are considered more significant than linear measurements,[16] it was determined to employ the following in this study (Fig. 1):

1. The three angles in the Margolis maxillofacial triangle.
2. The angle at S (sella turcica) formed by the Y axis and the S (sella)-N (nasion) line.
3. The gonion angle (Go).

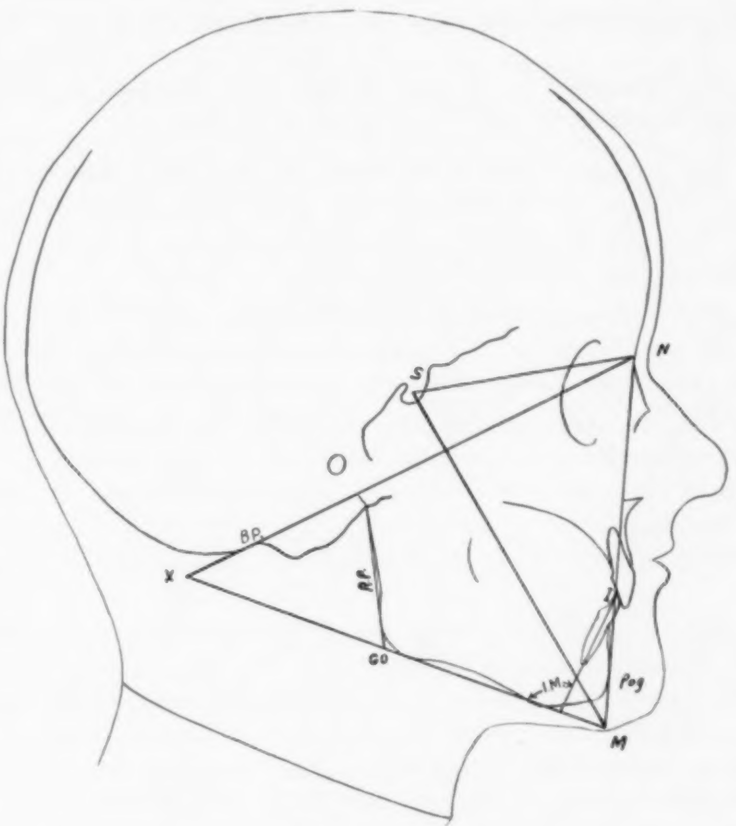

Fig. 1.—Lines and angles used in this study (see text).

4. The mandibular incisor-mandibular plane angle (I. M.).

A total of six different angle measurements was thus obtained from each of the 759 roentgenograms examined.

The Margolis maxillofacial triangle consists of the following (Fig. 1):

1. *The Cranial Base Line.*—The cranial base landmarks which may be used, as described by Margolis, are from nasion (N) (the junction between the sutures of the frontal and nasal bones) to one

of the following: (a) the cranial edge of the spheno-occipital synchondrosis, (b) the center of sella turcica, or (c) the Bolton point, the highest point on the concavity behind the occipital condyles as seen on the profile roentgenogram.

The cranial base line used in this study is the one from nasion (N) through Bp (Bolton point).

2. *The Facial Line.*—From nasion (N) through pogonion (the most anterior point on the mental protuberance of the mandible as seen on the profile roentgenogram) to the point of intersection with the mandibular plane at M.

3. *The Mandibular Line.*—Tangent to the inferior border of the mandible, intersecting the facial line at M and the cranial base line at X.

The angles described in the maxillofacial triangle used in this study are the following, as seen in the profile roentgenogram (Fig. 1):

1. *The craniofacial angle (XNM),* the angle at nasion formed by the cranial base line (N-Bp) and the facial line (N-M). This angle records the anterior developmental limit or position of the body of the mandible at pogonion.

2. *The faciomandibular angle (NMX),* the angle at M formed by the facial line (N-M) and the mandibular plane (M-X). This angle records the extent of vertical growth and development of the mandible.

3. *The craniomandibular angle (NXM),* the angle at X formed by the intersection of the cranial base line and the mandibular plane. This angle also records the extent of vertical growth and development of the mandible.

In addition, the following three angles were studied, making a total of six angles:

4. *The S angle, formed by the Y axis sella-nasion line (MSN).* The Y axis is described by Downs[17] as a line running from the center of sella turcica to gnathion (M) (the midpoint between the most anterior and inferior points on the mental protuberance as seen on the profile roentgenogram). The sella-nasion line runs from the center of the sella turcica to nasion. This angle records the extent of the downward and forward direction of facial growth (Fig. 1).

5. *The gonion angle* is the angle formed by the ramus plane and the mandibular plane. The posterior-inferior condylar point on the posterior surface of the ramus of the mandible was used in this study (Fig. 1).

6. *The mandibular incisor-mandibular plane angle,* the angle formed by a line bisecting the long axis of the mandibular incisor and extending to the mandibular plane line, as seen in the profile roentgenogram. This angle records the degree of incisor procumbency in relation to the mandibular plane (Fig. 1).

ANALYSIS OF DATA

In addition to obtaining an index of measurement for each of the angles studied by age of the children and by the city in which they resided, standards of angular measurement were obtained also for the group as a whole. To demonstrate meaningful angular differences, consideration must be given to clinical implications as well as to statistical significance.

The measurements of each of the six types of angles studied were grouped according to the age of the child at last birthday and the city of residence. Since it was desirable to obtain the central tendency in angular size of the respective population groups in each city according to age, the distribution of measurements was summarized according to the arithmetic mean of the respective groups measured with the appropriate standard error of the mean.*

Analysis of each of the six types of angles studied reveals the following:

1. *Margolis Maxillofacial Triangle (Three Angles).*—As indicated in Table II and Fig. 2, the difference between the children in Newburgh and in Kingston of the mean measurement for each of the three angles in the triangle is extremely small at all ages.

TABLE II. MEAN ANGLES OF THE MARGOLIS MAXILLOFACIAL TRIANGLE* BY AGE OF CHILD, NEWBURGH AND KINGSTON, NEW YORK

ANGLE	AGE AT LAST BIRTHDAY (YEARS)	NEWBURGH MEAN ANGLE (DEGREES)	NEWBURGH STANDARD ERROR OF MEAN	KINGSTON MEAN ANGLE (DEGREES)	KINGSTON STANDARD ERROR OF MEAN	BOTH CITIES MEAN ANGLE (DEGREES)	BOTH CITIES STANDARD ERROR OF MEAN
X-*N*-M	6	60.9	0.31	60.3	0.27	60.6	0.21
	7	60.7	0.26	60.8	0.33	60.7	0.20
	8	61.4	0.29	61.0	0.29	61.2	0.21
	9	61.6	0.30	61.7	0.41	61.7	0.25
	10	61.4	0.40	61.5	0.39	61.4	0.29
	Total	61.2	0.14	60.9	0.15	61.0	0.10
N-*M*-X	6	68.8	0.38	69.0	0.37	68.9	0.27
	7	69.2	0.37	68.4	0.42	68.8	0.28
	8	68.6	0.37	68.2	0.38	68.4	0.27
	9	68.6	0.39	68.3	0.49	68.5	0.31
	10	68.9	0.51	67.7	0.62	68.5	0.40
	Total	68.8	0.18	68.4	0.20	68.6	0.13
M-*X*-N	6	50.5	0.50	50.7	0.47	50.6	0.34
	7	50.1	0.47	50.5	0.48	50.3	0.34
	8	50.3	0.45	50.9	0.50	50.6	0.34
	9	49.8	0.50	49.9	0.59	49.8	0.38
	10	49.9	0.62	50.9	0.68	50.3	0.46
	Total	50.1	0.22	50.6	0.24	50.4	0.16

*N-B plane used as cranial base line.

The largest age-specific difference between the two cities was 1.2 degrees in the mean of the angle at M for 10-year-olds. In no age-specific comparison did the differences in angular measurement of the angles in the maxillofacial

*Inasmuch as each of the separate sample groups of children whose angles were measured by age and city represents only a portion taken from a larger total population, the mean of each of the samples can be considered only as an estimate of the true mean value of the total population from which the sample was drawn. To obtain the reliability of this estimate, the standard error of the mean of each sample group was determined. The interpretation of the standard error of the mean is that we have approximately 95 per cent assurance that the mean of the total population from which each of the respective samples was drawn will lie within the range of the sample mean ± twice its standard error.

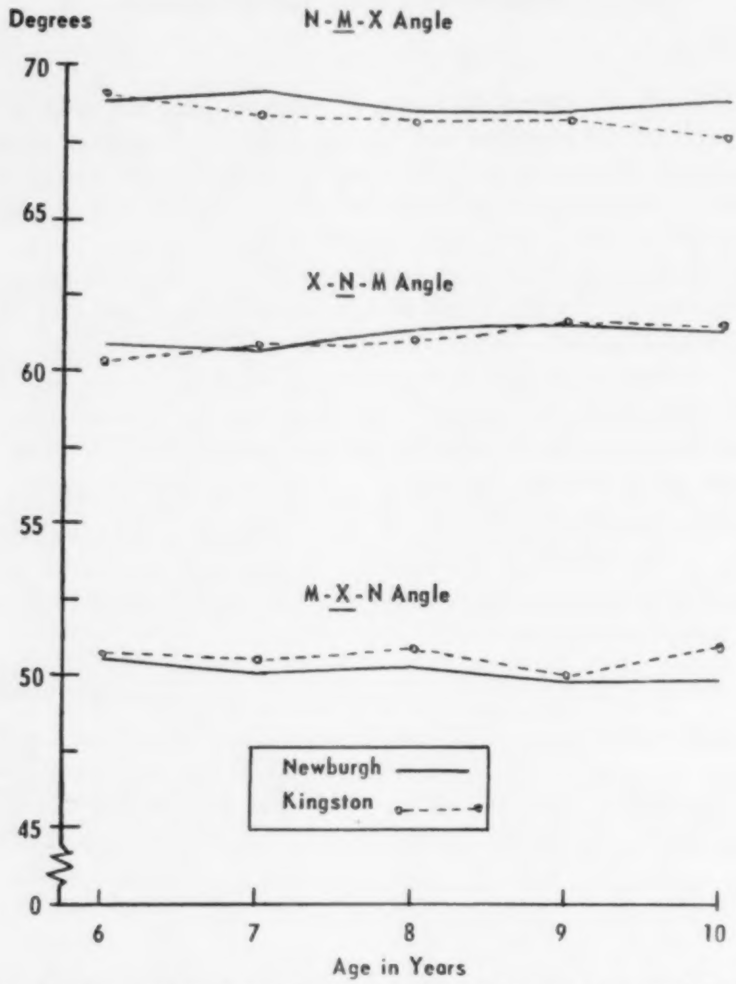

Fig. 2.—Mean of angles in maxillofacial triangle (N-B plane used as cranial base line) by age of child, Newburgh and Kingston, New York.

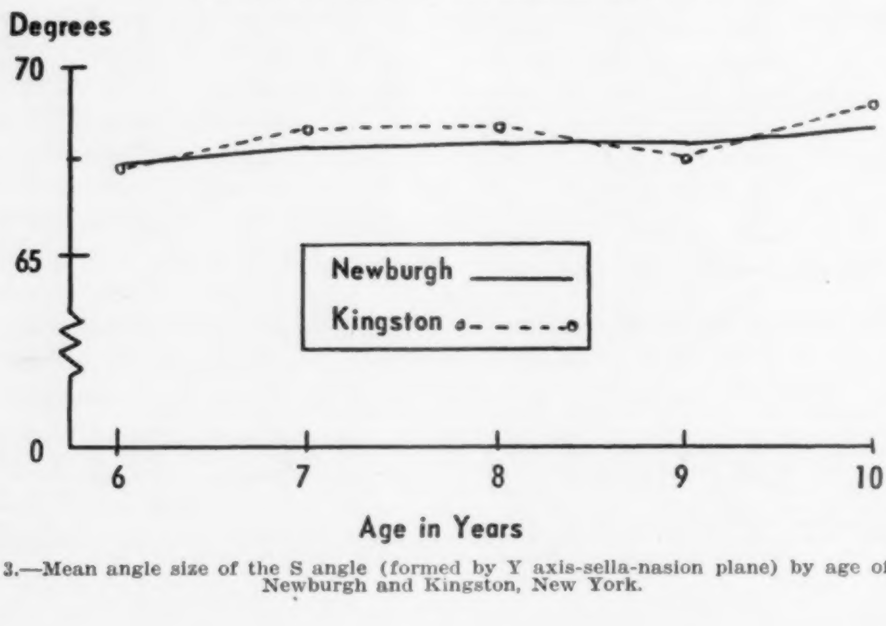

Fig. 3.—Mean angle size of the S angle (formed by Y axis-sella-nasion plane) by age of child, Newburgh and Kingston, New York.

triangle even approach statistical significance. Furthermore, there was no evidence of any association between angle size and age of the groups of children for any of the three angles in either of the cities. The maximum difference in means between any two age groups was less than 1.5 degrees.

The differences between Newburgh and Kingston in the over-all means for the entire age 6- through 10-year groups for each of the angles were only 0.3 degree for angle N; 0.4 degree for angle M; and 0.5 degree for angle X. Not only are these differences not significant statistically, but they are far too small to be of any clinical importance.

Margolis[18] proposed the maxillofacial triangle as a means of ascertaining the pattern of facial development. He based his findings on 100 white American children between the ages of 6 and 19 years, with well-developed, nonprognathous faces. Higley[19] presented mean averages of the angles in the maxillofacial triangle based on a study of North American white children of northern European ancestry. The mean measurements determined by Higley were made on twenty-five to thirty boys and a comparable number of girls in each age group from the ages of 4 through 8 years (Table III).

TABLE III. COMPARISON OF MEANS OF ANGLES IN THE MAXILLOFACIAL TRIANGLE AS FOUND BY HIGLEY, MARGOLIS, AND IN NEWBURGH AND KINGSTON, NEW YORK

ANGLE	MEAN ANGLE IN DEGREES		
	HIGLEY	MARGOLIS	COMBINED NEWBURGH AND KINGSTON
X-*N*-M	60.5	61.0	61.0
N-*M*-X	68.4	68.0	68.6
M-*X*-N	51.2	51.0	50.4

Note: Ages of groups studied:
Higley ______________________ 6 through 8 years.
Margolis ____________________ 6 through 19 years.
Newburgh-Kingston __________ 6 through 10 years.

The similarity of measurements of the angles in the maxillofacial triangle, irrespective of age (in the age range of 4 through 19 years), in three studies (Margolis, Higley, and Newburgh-Kingston) leads us to deduce that the facial growth pattern in man is established early in childhood. While the face continues to grow in size and to change in proportion, the basic pattern shows a tendency to remain the same, when measured according to the maxillofacial triangle. Furthermore, our results indicate that the consumption of fluoridated drinking water has no effect on this pattern of facial growth.

2. *The S Angle (Table IV and Fig. 3).*—No meaningful difference was found between the Newburgh and Kingston children in the size of the angle at S. The largest age-specific difference was only 0.5 degree in the 10-year-old group, with none of the age-specific differences being statistically or clinically significant.

Table V shows the close similarity of the means of the S angle as reported by Higley and the Newburgh-Kingston group. As also shown in Table V, there is no evidence of any association of the size of the S angle with the age of the child. When all ages were combined, the S angle was 67.9 degrees for each city and differed by only 0.3 degree from the mean derived from the

TABLE IV. MEAN ANGLE SIZE OF THE S ANGLE* BY AGE OF CHILD, NEWBURGH AND KINGSTON, NEW YORK

AGE AT LAST BIRTHDAY (YEARS)	NEWBURGH		KINGSTON		BOTH CITIES	
	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN
6	67.4	0.37	67.3	0.27	67.3	0.22
7	67.9	0.34	68.3	0.37	68.1	0.25
8	68.0	0.34	68.3	0.36	68.2	0.25
9	67.9	0.43	67.6	0.48	67.7	0.32
10	68.4	0.41	68.9	0.58	68.6	0.34
Total	67.9	0.17	67.9	0.17	67.9	0.12

*S angle is formed by Y axis-sella-nasion plane.

Higley data, and by 0.0 degree from the Northwestern University Clinic data reported by Riedel.[20] There is no difference, therefore, in the downward and forward growth of the face between children in fluoridated areas and those in nonfluoridated areas, as indicated by the angle formed by the Y axis and sella-nasion plane.

TABLE V. COMPARISON OF MEANS OF THE S ANGLE* BY AGE OF CHILD AS DETERMINED BY HIGLEY AND IN NEWBURGH-KINGSTON CHILDREN

AGE (YEARS)	MEAN ANGLE IN DEGREES			
	NEWBURGH	KINGSTON	COMBINED NEWBURGH AND KINGSTON	HIGLEY
6	67.4	67.3	67.3	67.3
7	67.9	68.3	68.1	67.7
8	68.0	68.3	68.2	68.3
9	67.9	67.6	67.7	--
10	68.4	68.9	68.6	--

*S angle is formed by Y axis-sella-nasion plane.

3. *The Gonion Angle.*—The mean gonion angle for children aged 6 through 10 years in Newburgh was 127.3 degrees, and for those in Kingston, 128.5 degrees (Table VI). The over-all mean for both cities was 127.9 degrees. From Higley's data, we find an over-all mean of 127.6 degrees in a group of children aged 6 through 8 years (Table VII).

TABLE VI. MEAN ANGLE SIZE OF THE GONION ANGLE BY AGE OF CHILD, NEWBURGH AND KINGSTON, NEW YORK

AGE AT LAST BIRTHDAY (YEARS)	NEWBURGH		KINGSTON		BOTH CITIES	
	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN
6	128.5	0.57	130.3	0.50	129.6	0.38
7	128.1	0.55	128.6	0.63	128.3	0.41
8	126.4	0.59	126.9	0.62	126.7	0.43
9	126.6	0.61	127.4	0.69	127.0	0.46
10	126.9	0.83	128.4	0.86	127.5	0.61
Total	127.3	0.28	128.5	0.29	127.9	0.20

None of the age-specific comparisons between Newburgh and Kingston were statistically significant at the 1 per cent level; that is, there is more than one chance out of 100 that the difference is due to chance alone and not

TABLE VII. COMPARISON OF MEANS OF GONION ANGLE BY AGE OF CHILD AS DETERMINED BY HIGLEY AND IN NEWBURGH-KINGSTON CHILDREN

AGE (YEARS)	MEAN ANGLE IN DEGREES			
	NEWBURGH	KINGSTON	COMBINED NEWBURGH AND KINGSTON	HIGLEY
6	128.5	130.3	129.6	125.5
7	128.1	128.6	128.3	127.6
8	126.4	126.9	126.7	128.0
9	126.6	127.4	127.0	--
10	126.9	128.4	127.5	--

to any real difference in the size of the gonion angle between children in the two cities. However, the consistently higher over-all mean angle for the children in Kingston was found to be statistically significant (P = .003).* This would make it appear that the children in Newburgh have a more favorable development of the lower third of the face (Fig. 4). Here again the magnitude of the difference between the over-all means is very small, being only 1.2 degrees, and is of no clinical significance. The foregoing, therefore,

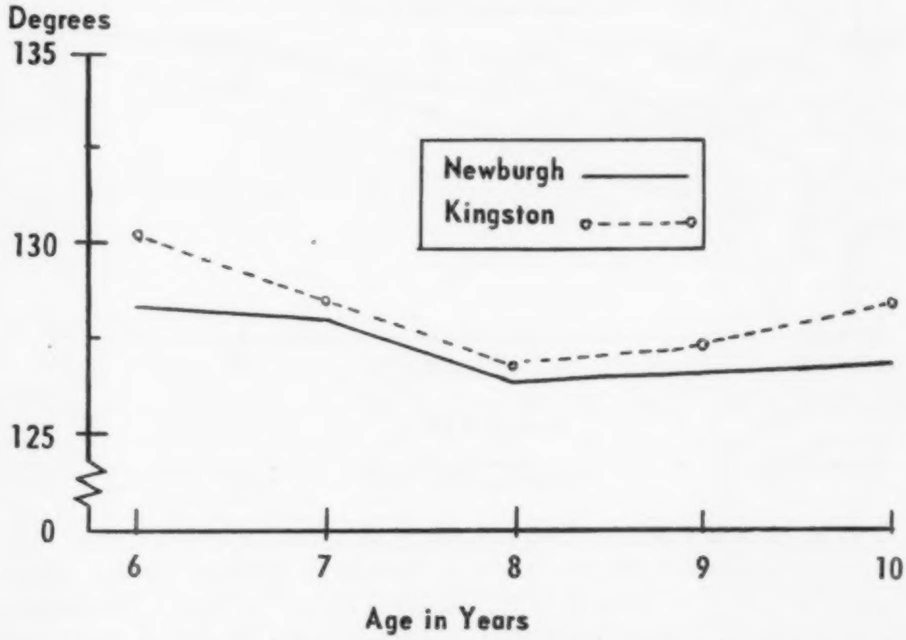

Fig. 4.—Mean angle size of the gonion angle by age of child, Newburgh and Kingston, New York.

is accepted to indicate no meaningful difference in the angle at gonion between children consuming fluoridated water and those who drink fluoride-deficient water.

Additional statistical analyses of the gonion angle disclose a growth trend in this angle which warrants further study for general orthodontic diag-

*P of .003 means a probability of 3 in 1,000 that this difference may be due to chance only.

nostic reasons (Fig. 4). In each of the two cities, the mean gonion angle size decreased successively from the ages of 6 to 8 years, after which the mean size of the angle showed successive increase in size for the 9- through 10-year-old groups.

While the difference in decrease of mean gonion angle size between the 6- to 8-year-old groups was statistically significant, the amount of increase between the ages of 8 and 10 years was not statistically significant. This suggests that, on a longitudinal study, it also may be found that the gonion angle varies with age. The difference observed in this cross-sectional study in the mean gonion angle between the ages of 6 and 8 years in Newburgh was 2.1 degrees and in Kingston it was 3.4 degrees.

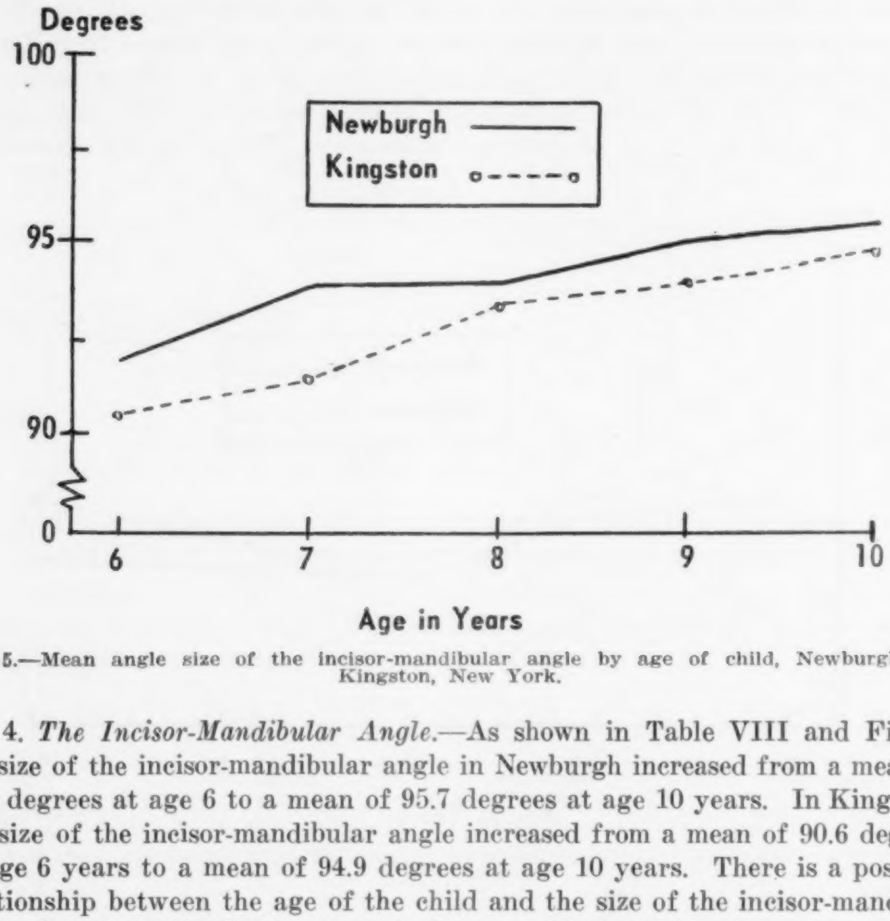

Fig. 5.—Mean angle size of the incisor-mandibular angle by age of child, Newburgh and Kingston, New York.

4. *The Incisor-Mandibular Angle.*—As shown in Table VIII and Fig. 5, the size of the incisor-mandibular angle in Newburgh increased from a mean of 92.1 degrees at age 6 to a mean of 95.7 degrees at age 10 years. In Kingston, the size of the incisor-mandibular angle increased from a mean of 90.6 degrees at age 6 years to a mean of 94.9 degrees at age 10 years. There is a positive relationship between the age of the child and the size of the incisor-mandibular angle. Not only did the mean incisor-mandibular angle size increase with the age of the child, but it was a regular gradient of increase and was higher at each age level for the Newburgh group. The relative increase from 6 to 10 years of age was the same in each of the cities.

The differences in age-specific comparisons between Newburgh and Kingston were not statistically significant at the 1 per cent level. Furthermore, the differences were too small to have any clinical significance.

TABLE VIII. MEAN ANGLE SIZE OF THE INCISOR-MANDIBULAR ANGLE BY AGE OF CHILD NEWBURGH AND KINGSTON, NEW YORK

AGE AT LAST BIRTHDAY (YEARS)	NEWBURGH		KINGSTON		BOTH CITIES	
	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN	MEAN ANGLE (DEGREES)	STANDARD ERROR OF MEAN
6	92.1	0.74	90.6	0.64	91.2	0.49
7	93.9	0.65	91.5	0.78	92.9	0.51
8	94.0	0.61	93.5	0.57	93.7	0.42
9	95.2	0.69	94.0	0.94	94.7	0.57
10	95.7	0.79	94.9	1.10	95.4	0.65
Total*	94.0	0.32	92.7	0.33	93.3	0.23

*Adjusted for increase of angle size with age.

The trend of incisor-mandibular angular growth, however, is of interest in that it portrays the path of eruption of the mandibular incisors as seen on the profile roentgenogram. As was mentioned previously, the children in Newburgh and in Kingston showed a steady increase in size of the incisor-mandibular angle from the ages of 6 to 10 years, inclusive. The groups examined by Higley showed a much more pronounced increase in the incisor-mandibular plane angle between 6- and 8-year-olds (Table IX).

TABLE IX. COMPARISON OF MEANS OF INCISOR-MANDIBULAR ANGLE BY AGE OF CHILD AS DETERMINED BY HIGLEY AND IN NEWBURGH-KINGSTON CHILDREN

AGE (YEARS)	MEAN ANGLE IN DEGREES	
	COMBINED NEWBURGH AND KINGSTON	HIGLEY
6	91.2	85.9
7	92.9	90.5
8	93.7	95.2
9	94.7	- -
10	95.4	- -

The over-all mean angle, adjusted for age, among the Newburgh children (94.0 degrees) was larger than that for the Kingston group (92.7 degrees). However, while this difference was of statistical significance, it was too small to be considered of any clinical importance.

DISCUSSION

The purpose of this study was to determine any existing differences in facial growth and development between children consuming fluoridated water and those who drink fluoride-deficient water.

The dentofacial growth and development study here presented is based on cephalometrics obtained from 8 by 10 inch profile roentgenographs. Included in this study are six angular measurements of dentofacial growth of each of 759 children, aged 6 to 10 years, inclusive; 386 resided in Newburgh, where the central water supply for the past nine years has been supplemented to bring its fluoride content up to 1.0 to 1.2 ppm, and 373 children resided in Kingston, where the central water supply is fluoride-deficient.

Determinations were made of the mean, and standard error of the mean, of the following angles: N, M, and X as described in the Margolis maxillofacial triangle, with N-Bp as the cranial base; the angle at S formed by the Y axis and sella-nasion line; the angle at gonion; and the mandibular incisor–mandibular plane angle.

Margolis presented the maxillofacial triangle as a means for measuring the over-all facial growth and development pattern. The landmarks employed in the triangle are located at easily discernible points on the profile roentgenogram, especially in the age groups used in this study. The interdependence of the size of the angles of any triangle makes it a valuable attribute in dentofacial studies, since it reveals the relative difference in size and relationship of specific maxillofacial areas to each other. In this manner we are able to determine specific sites of growth change.

The data obtained for the Newburgh-Kingston children show the facial pattern to be the same for children in a fluoridated community as for those in a nonfluoridated area, and the children in both cities show angular measurements in the maxillofacial triangle which are similar to the values reported independently by Margolis and others.

Furthermore, the similarity in the size of the angles from age 4 years through age 19 years, as found by Margolis,[18] Higley,[19] and in the Newburgh-Kingston study, indicates a constancy of the facial growth pattern throughout the period of major growth and development of the face.

The angle at sella, formed by the Y axis and S-N line, shows the degree of downward and forward growth of the face. The findings for Newburgh and Kingston showed no difference between children consuming fluoridated and nonfluoridated drinking water. In addition, the over-all mean angle among these children was similar to those reported independently by Higley and at Northwestern University by Riedel.[20]

While the over-all mean of the gonion angle for the Kingston children was significantly higher statistically than the Newburgh group, the difference between the two cities was too small to be clinically important. In our data there is some suggestion of variation in the size of the gonion angle with age of child. The gonion angles for the Newburgh-Kingston children showed a statistically significant decrease in size from ages 6 to 8 years, inclusive, and an increase of no statistical significance from ages 8 through 10 years.

Brodie[21] found the growth pattern of the human head, based on a study of twenty-one boys from the third month to the eighth year of life, to follow parallel planes. Later studies by Brodie,[22] in which nineteen persons of a more advanced age were measured, revealed that in the male, at least, there is a tendency in some persons for the gonion point to descend more rapidly, thus decreasing the slant of the mandibular plane angle and decreasing the size of the gonion angle. In most persons the angle at gonion, according to Brodie,* remains constant but those that change show a decrease. Brodie

*Personal communication to the authors.

has not reported on the gonion angle in females, but believes that this change may be a secondary sex characteristic in males, since the change seems to appear at puberty. Our findings show a decrease in the size of the gonion angle to take place also between 6 and 8 years of age. There appears to be a need for further longitudinal studies of the gonion angle, and especially for a definition of the registration point at the mandibular condyle.[23]

The incisor-mandibular angle, which assumed great importance in orthodontic diagnosis with the notable contributions of Tweed,[24] is a far from settled question. Downs[17] found a mean of 91.4 degrees for the mandibular incisor angle, using menton as the anterior point for the mandibular plane. This measurement would have a tendency to decrease the size of the mandibular incisor–mandibular plane angle.

Speidel and Stoner,[25] in 1944, determined the size of the mandibular incisor–mandibular plane angle in forty-two young male adults who had definitely superior to almost ideal dental occlusal relationships. They found a mean incisor–mandibular plane angle of 92.64 degrees. Riedel,[20] in 1952, found the mandibular incisor–mandibular plane angle to show a mean of 93.096 degrees for adults and 93.52 degrees for children 8 to 11 years of age.

Broadbent,[26] in a longitudinal study, examined twenty-five white boys between the ages of 3 and 18 years. He found the angle at 3 years to measure 92 degrees; at 16 years it was 96 degrees; and at 18 years it measured 94 degrees. Brodie,[27] in 1942, found the mandibular incisors at the time of their eruption to be practically vertical to the mandibular plane. Our findings seem to agree with those of Brodie.

The determinations for the incisor-mandibular angle in our study showed an over-all mean, adjusted for age, of 94.0 degrees for Newburgh and 92.7 degees for Kingston. Although of statistical significance, this difference in the means of the incisor-mandibular angle for the groups in Newburgh and Kingston does not appear to be of any clinical importance. The growth pattern of the mandibular incisors shows a tendency for these teeth to increase in procumbency at least up to the age of 10 years, which is the maximum age in this study.

We have demonstrated that the mean values of cephalometric measurements of children in a fluoridated area show no differences of clinical significance from children in a fluoride-deficient area. This, along with the fact that the mean values for both groups of children show close similarity to the values independently obtained by other investigators, permits us to establish mean standards for the dentofacial growth patterns studied. However, such mean values are not ready for use as absolute criteria in clinical orthodontic diagnosis. The reported mean measurements are derived from a wide range of values which run from a very low to a very high value. It is not the mean per se which should be used as a criterion, but an established normal range about the mean.

Wylie[28] cautions, "Orthodontists preoccupied with the clinical problem rather than with research must avoid excessive reliance upon average values . . ."

Variation about the mean is always present in biologic measurements, as, for example, in blood pressure values, blood counts, urinary components, height, weight, etc. Nevertheless, these phenomena are measurable for diagnostic purposes because of the important factor which has been established for them, but which is still lacking in so far as positive diagnostic criteria in orthodontics are concerned, that is, a "normal range" of values to be used as a baseline.

For cephalometric criteria to be used in orthodontic diagnosis with scientific accuracy, it is essential that a normal range of values be determined and that any values which fall outside the normal range be associated with an abnormal condition of dentofacial growth and/or malocclusion of the teeth, such an association not holding for the normal group. What the "normal range" of values is for any given cephalometric measurement in orthodontics is, as yet, an unknown quantity. Until such a positive range of values is established, it would be inaccurate to accept mean cephalometric measurements of children en masse as positive, clinical, diagnostic criteria for the child as an individual.

SUMMARY

1. A series of six angles were measured on profile roentgenograms of each of 386 children in Newburgh, New York, who drink water containing 1.0 to 1.2 ppm fluoride and a control group of 373 children in Kingston, New York, who consume fluoride-deficient water.

2. The mean and standard error of the mean of the angles studied were determined for each of the 759 children in the entire group by age and city.

3. No meaningful differences were found between children in the community with fluoride-containing water and the fluoride-deficient area.

4. Angular measurements of dentofacial growth and development are presented in support of certain existing standards. In addition, measurements are presented for the establishment of some new standards for other dentofacial angles.

5. In order for cephalometrics to be useful in clinical diagnosis of the individual, it is necessary to establish a "normal range" of variation as a base line which excludes measurements that fall outside the "normal range" of variation and are associated with specific dentofacial growth abnormalities and/or malocclusion of the teeth.

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INADEQUACY OF MANDIBULAR ANCHORAGE

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FOR a number of years now, I have felt that many of us, consciously or unconsciously, have been avoiding an issue that is important to the final results of our treatment procedures. I refer to the inadequacy of the mandibular arch in resisting the forward horizontal stress placed upon it by intermaxillary elastics. Specifically, this may result in the forward movement, tipping, and crowding of one or more of the mandibular teeth. These malpositions disturb occlusal relations, are unsightly and unsatisfactory to patients and parents, and are capable of inducing pathology in adjacent tissues. This may occur during or after active treatment or may not become apparent until long after retention. In treating certain Class I cases with protrusion of maxillary anterior teeth or with shortened arch length as a result of forward drift of maxillary molars, most of us depend to varying extent upon mandibular anchorage. More particularly, it is used habitually in the many and varied types of Class II, Division 1 and, to a lesser extent, in Division 2 cases. The situations mentioned, and especially crowding in the anterior portion of the arch, may also occur, of course, without orthodontic interference and often may be apparent before treatment is started.

May I note, for a moment, the possible ways in which the so-called "normal" mandibular crowding and tipping occur. Sicher[1] states: "All teeth, maxillary and mandibular, move toward the midline (mesial drift) throughout life. Crowding of lower front teeth is a frequent occurrence at the end of the period of body growth.[16-22] It is not known what factor is responsible, but it can be stated that the cause *is not* the erupting third molars." Halderson, Johns, and Moyers[2] note also that there is a constant tendency for teeth to move mesially since the "vectors of the contraction of the tongue and buccal wall muscles are mesial in direction." This seems to be a generally accepted theory in orthodontic circles, although Krogman[3] is not in full agreement. He states: "I grant that the general facial growth is forward and downward, more the first than the second. I also grant that eruptive direction (besides vertical emplacement) is forward. In other words, dynamics of growth and eruption tend to be mesial. But this is growth; this is adjustive; this is movement in keeping with incremental dimension. *After* the growth process is achieved the attained equilibrium is in balance; by this I suggest that tooth, bone, and muscle unite or combine functionally to conduce to a status quo. The study of split-lines and trabeculation in the bones suggests that transmitted force (in mastication and occlusion)

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slightly favors a distal direction since the major force emanates from the posteriorly located temporomandibular locus. I do not think, in conclusion, that the mesially inclined growth force is maintained after eruption." One notes that Krogman limits his statement to growth dynamics only and does not include other mesial drift tendencies.

Abnormal function of the tongue may be added as a possible cause of crowding. Swinehart[4] has expanded contracted posterior arches in young children. He indicates that this allows the tongue to function normally and, as a result of this activity, has shown cases exhibiting a natural unfolding of crowded mandibular anterior teeth. One might assume, therefore, that normal tongue activity early in life helps the mandibular arch to develop normally and abnormal tongue activity may at least allow crowding to take place.

Moore[5] states: "Perhaps as a reasonable supposition, we may have what may be termed 'normal crowding' of mandibular anterior teeth due to differentials in growth—in other words, difference in growth at the various growth sites. If the condylar bone growth, as a result of proliferation of cartilage, continues beyond the bone growth at the maxillary tuberosity, the mandible moves forward. If the maxillary anterior teeth do not move forward and are constricted in position by the band of lip muscles, they will press on the mandibular anterior teeth and cause this so-called 'normal crowding' due to growth."

This may be most apparent in straight-faced persons, that is, those with a small SNA-SNB difference. If the mandible continues growth, further reducing the difference, we may have the lower incisors moving into a traumatogenic occlusion. Thompson[6] believes that this condition, sometimes causing a double tap as the mandible brings the teeth together, may cause crowding.

It is also possible that disharmonies may result from discrepant heredity, such as large teeth with a small bony support or relatively larger anterior teeth in the mandibular arch than in the maxillary arch. Parts may be normal but they do not fit.[7]

Still other reasons for mesial movement of mandibular teeth (as well as maxillary teeth) have been indicated by Weinmann and Sicher[8] as due to apposition of bone throughout life on the distal wall of each alveolus. Dewel[9] includes also the possibility that the design of posterior teeth, especially the mandibular first molar with the crown being offset mesially of center, may result in still further mesial movement. He states: . . . acknowledgement is made of factors of crown design, bone apposition, muscular pressure, and axial inclination for the purpose of maintaining contacting relations between teeth. But they also provide evidence that teeth tend to move mesially, and that they may do so beyond normal limits."

Probably other considerations might be mentioned, such as lack of vigorous mastication through several generations, evolutionary trend, etc.

However, there is little that we can do about these things other than speculate about them. What we should be interested in is when this situation is further

complicated by orthodontic treatment, or when, with no apparent abnormalities of mandibular teeth present, this situation is initiated by orthodontic treatment. We may, however, unconsciously or consciously, avoid the subject because the phenomena that cause the malpositions of mandibular teeth are natural phenomena. We may say, "Well, the lower anteriors are going to crowd up some anyway. Why be bothered?" Many excellent orthodontists, realizing that normal crowding of mandibular anterior teeth may occur, are not too concerned as long as such crowding does not affect function, is not likely to cause pathologic involvement, or does not seriously affect appearance. But we are on precarious ground when we use mandibular teeth for anchorage and subject them to prolonged forward horizontal stress. These teeth, like the teeth to be moved, are embedded in living bone. If "it is easier to move teeth mesially than distally," the teeth of the mandibular arch are especially unsuitable for effective resistance to a forward elastic pull. Howes[10] states that "Brodie and others have called attention to the increase in the angle which the occlusal plane makes with the Frankfort horizontal plane as a result of intermaxillary force in the treatment of distoclusion. Brodie says that the plane tends to return to its original cant after retention is discontinued, which might be one of the reasons why the mandibular incisors often become gradually more crowded after Class II intermaxillary elastics have been employed." There are, of course, a few cases with excellent tooth and bone structure which seem to offer good enough resistance. It is unfortunate that, before we plan treatment, we cannot in some way determine how resistant mandibular bone will be to stress. As Sicher[11] notes, "There is no means to judge, by x-rays or otherwise, the 'quality of bone.' Quite especially, we have no reason to believe than any specific structure of the trabeculae in the alveolar bone has any influence on its resorbability. Under pressure this bone is resorbed by osteoclasts no matter what shape or size the trabeculae are."

MacEwan[12] suggests the possibility that width of periodontal membrane, continuity of lamina dura, trabecular pattern, and pathologic conditions may be noted in x-ray examination and considered in estimating possible stability of anchor units and instability of teeth to be moved. He states that a periodontal membrane which is wider than usual indicates instability. The lamina dura, if lacking in continuity, also indicates lowered resistance to movement. Sparse trabeculation or a granular appearance indicates a probable lack of resistance. Sclerotic areas, scar areas of bone, etc., indicate the probability of resistance to movement.

It may be appropriate to deviate a little at this point to enlarge a bit on the situations in which most of us routinely utilize the mandibular arch for anchorage and to introduce some recent thought on Class II treatment.

Class I cases, as mentioned previously, presenting protrusion of maxillary anterior teeth and shortening of arch length with mesial drifting of maxillary molars are commonly treated by means of intermaxillary elastics.

Studies at the University of Toronto[13] indicated: "There are at least six possible morphologic variations in the dento-facial complex which may result in Class II, Division 1 malocclusions. These are as follows:

"1. Maxillary bones and teeth anteriorly situated with relation to the cranium.

"2. Maxillary teeth anteriorly placed in the maxillary bone.

"3. Mandible underdeveloped.

"4. Mandibular teeth posteriorly placed on adequate bone.

"5. Mandible of normal size but posteriorly placed.

"6. Any combination of the above."

Treatment of any of these conditions, except the fourth which Grieve[14] and others have doubted as a possibility, would necessitate either posterior movement of maxillary teeth or the forward movement of the mandible without forward positioning of the mandibular teeth. It should be noted that in this same Toronto study Class II, Division 2 was mentioned as meeting Angle requirements for Class I and that the important treatment procedure was the distal movement of maxillary buccal segments. (Of course, there usually is also an important and difficult vertical problem familiar to all orthodontists.) Again, the standard procedure for moving maxillary buccal segments distally could involve mandibular anchorage. In the Class II, Division 2 cases, the stress may not need to be so severe or prolonged (as in Class II, Division 1), since some degree of reciprocal anchorage usually can be employed between buccal and anterior segments of the maxillary arch; that is, the maxillary anterior teeth are often tipped back. We also get an "assist" from the usually firm lip muscles.

Fischer[15] includes five types of Class II, Division 1 malocclusion, namely:

1. Maxillary protrusion.
2. Bimaxillary protrusion.
3. Mandibular retrusion, pseudo.
4. Mandibular retrusion, structural.
5. Retrusion of the mandibular dental arch.

Here, also, we find that only in the fifth category (retrusion of the mandibular dental arch) would it be permissible, with intermaxillary elastics, to allow a forward movement of the mandibular teeth.

Apparently as a result of recent cephalometric studies, there are some who feel that moving maxillary molars distally and holding them there is a doubtful procedure. Downs[16] puts the matter concisely when he states: "Cephalometric studies of tooth movement show that there is really very little actual bodily distal movement of the maxillary molars. Usually the crowns are tipped distally, often with a compensating mesial movement of the apices. True distal movement has been observed in some cases, especially as the result of extraoral traction. What appears to happen in most cases is that the first molars are tipped distally and the tooth descends without much forward movement. This actually accounts for many of the shifts of molar occlusion from Class II to Class I, because during

the period of treatment the mandibular denture is carried forward by its normal growth potential. This applies to growing individuals. When growth stops, this possibility ceases.

"I think there are many cases in which, due to an unfavorable growth potential of the individual or insufficient arch length, it is unwise to attempt too much distal movement of the molars, because of the danger of jamming in the distal extremities of the arch with resulting relapse tendencies when the first molars tend to move forward during retention because of this jamming.

"Personally, I prefer not to attempt too much distal movement of molars unless I feel that the case is going to enjoy excellent growth. I would rather, in many cases, prefer to retract protrusive anterior teeth by sacrificing something in the buccal segments, rather than creating a jamming in the molar areas."

Howes[17] writes: "Summing up distal movement as a treatment procedure . . . it can be used in the maxillary arch if the basal arches are sufficient in width and length and if the mandibular buccal teeth are not forward of their normal positions. To accomplish the movement, extra-oral force should be used if possible. If intermaxillary force is used, it should be kept to a minimum."

Thompson[18] states: "I do not have any confidence in saying that a molar was moved 1 mm. or 2 mm. mesially or distally (cephalometric radiography tracing measurement) because slight rotation of the head introduces an error into all lateral points."

At the last Denver Summer Meeting, Moore[19] presented some suggestions on treatment which were in accord with the descriptions of the various types of Class II, Division 1 cases given by the Toronto group and Bercu Fischer:

"1. Inhibit the normal forward movement of the denture.
"2. Control the eruption pattern of the teeth.
"3. Move the denture posteriorly.
"4. Create space in which to move the teeth by selective extraction."

Now to apply these same four factors to the mandible, we have:

"1. Stimulate or promote the growth horizontally and vertically in the mandibular bone.
"2. Control the eruption pattern of the teeth.
"3. Move the denture anteriorly.
"4. Create space in which to move teeth by selective extraction."

It might be mentioned that both the maxillary and mandibular No. 2 step, concerning the eruption pattern of the teeth, refers to establishing as nearly as possible a normal vertical overbite. In all the other steps, use of mandibular anchorage ordinarily might be standard practice. Again, the No. 3 step in his therapy is the only one which could allow forward movement of mandibular teeth.

To more or less complete present-day thought on the treatment of Class II malocclusions, I quote Donovan:[20]

"The orthodontic treatment of Class II malocclusion seems to depend to a great extent on the inhibiting forces applied to the maxillary arch.

"1. Class II elastics.
"2. Cervical or occipital appliances.
"3. Bite plates.
"4. Oral shields.
"5. Muscle therapy.

(a) Coordination of bone, tooth, and muscle development.
(b) Elimination of bad habits.
(c) Improvement of functional patterns.

"If there is considerable horizontal growth, it seems possible, especially with the use of cervical or occipital forces, orthodontically to:

"1. Inhibit somewhat the forward path of the maxillary molars so as to attain an adequate arch length.
"2. Inhibit somewhat the forward path of the maxillary dental arch in correction of Class II arch relation.
"3. A combination of 1 and 2.

"If there is a maxillary growth pattern in an equalized horizontal and vertical path, the same three combinations are possible, but not as readily successful.

"If the maxillary growth pattern is mainly in a vertical direction, the three possibilities are not often successful and extensive tipping and extraction must be resorted to more frequently."

In all the yeasty ferment going on, mainly as a result of cephalometric radiography studies, we note that the problem of mandibular anchorage is still with us. It may be modified, since these investigators do not, in Class II, Division 1 cases, attempt to "haul" the mandible forward—they "encourage growth." They prefer to "inhibit" forward growth in the maxilla, rather than "push" the maxillary teeth distally. Thus, Class II elastics may not be utilized with so much abandon but they still are part of the armamentarium, even among the most enlightened.

To simplify matters, we will omit those cases which include the extraction of four premolars in treatment procedures; this may often allow some alleviation of the problem of mandibular anchorage, since the mandibular posterior teeth are often moved forward into part of the newly created space and this permits some reciprocal intramaxillary anchorage resulting in little forward pressure on the anterior segment.

For those cases, then, in which extraction of four premolars is not a suitable procedure, many remedies have been suggested.

1. *Multi-banding of all or most of the mandibular teeth* as in the Universal or edgewise techniques. The advantage ascribed to this method lies in the increase in the number of resistance units available and also in the fact that the teeth are so bound together that individual tooth movement is resisted by the other teeth in the arch. The teeth of the mandibular arch may be deliberately prepared for anchorage by tipping them back, although some

believe that such heroic measures are undesirable and are content to build the mandibular arch up to a rectangular wire without tipping. Multi-banding may have its disadvantages, however, in that it presumably creates an immediate disturbance of the periodontal and transseptal fibers throughout the entire arch and results, also, in immediately affecting the transitory cells of the alveolar bone. These changes, causing instability of the tooth units, occur, as Oppenheim[21] pointed out, even when teeth are separated for banding. The arch wires connecting and binding the teeth together prevent, to some extent, the natural "give" experienced by unfettered teeth under the forces of occlusion and mastication—and this may add to instability. The economic problem is also important if, as we agree, we wish to extend our services to as many as possible. The multi-banding technique requires a great deal of time and increases the cost to the patient, thus decreasing the number of patients per orthodontist and limiting these patients within certain inescapable economic boundaries. In a paper published in our JOURNAL some years ago, the late Charles Waldo[22] stated that we had to be more realistic in considering how we could serve a larger economic segment of our people. Otherwise, he said, each of us would become "just a little man working his established hours in a little room for a few years." Among other things, he advocated the use of simpler techniques.

In many cases, usually treated by the use of Class II intermaxillary elastics, the individual teeth of the mandibular arch do not require movement. Graber[23] states, for example, that out of 150 consecutive Class II, Division 1 cases, 107, or 75 per cent, had normal mandibular arches. Therefore, it would seem poor policy to subject these normally positioned teeth to multi-banding if any other means were available. It is probable that some of these cases were "normal" as far as the horizontal positioning of mandibular teeth was concerned but did have an excessive curve of Spee. This must be corrected before normal interdigitation with the maxillary denture can be achieved. Strang,[24] in a paper read before the Northeastern Society of Orthodontists (a paper which, to my mind, is a remarkably succinct and lucid exposition of our problems), states that it is necessary to band all the mandibular teeth, including the second molars, in this stage of treatment. It seems to me that this depends upon the individual patient and especially upon the eruption stage during which this correction is attempted. It has been accomplished in many cases using a simple lingual arch and in others using a bite plate or guide plane. There does not seem to be any rule for this procedure which, after all, is typical of most of our procedures. Although I am convinced that many cases do require what might be termed the "full treatment," I am still seeking gentler and easier methods for establishing and maintaining mandibular anchorage. Please note that I say I am still *seeking.*

2. *Utilizing the mandibular teeth for anchorage purposes before any movement is attempted or permitted in this arch.* This would suggest the use of appliances of uncomplicated design. It is said that teeth which have not been under pressure, in which the periodontal membranes and alveolar bone have

not been disturbed, and in which abnormal osteoclastic and osteoblastic activity is not taking place will tolerate more pressure without being themselves moved. The initial pressure for *starting* movement is, apparently, greater than that needed for *continued* movement. We should try, therefore, to prevent *initial* movement of anchor units, if possible. I have used a soldered lingual arch for many years; at first, because it was easily and simply made and applied and practically eliminated "wire breaking." Later, it dawned upon me that it provided more stable anchorage. If made to approximate passively and closely the lingual surfaces near the gingiva and allowed to remain in place for several weeks before elastic therapy is attempted, it should come close to fulfilling the preceding requirements. One objection to the use of a simple lower lingual arch in connection with the prolonged use of Class II elastics, often expressed by Jackson, is the production of an open-bite due to elevation of posterior teeth and possible depression of anterior teeth. Prolonged elastic force, therefore, must be avoided in using this arch in any case with a tendency toward open-bite. Wilson's[25] use of a removable lingual arch with loops indicates that this type of anchorage is adequate in some Class II cases if designed, inserted, and manipulated properly. He states: "I must confess that the feeling of our group [in the Boston area] is that this is adequate in almost all Class II cases." This, to me, is an interesting development requiring further examination.

Some apparently believe that a plain labial arch closely adapted to the labial surface of the six anterior teeth might supplement the anchorage furnished by the lingual arch. It is well known that McCoy, using a removable lingual arch, and Oliver, using a labiolingual combination, have demonstrated successful treatment of Class II conditions. It seems probable that certain men exhibit a genius for working with appliances of their choice and obtain results generally unattainable by the less gifted. As in multi-banding, neither the lingual arch nor the labiolingual combination has proved in itself to be a universal panacea.

3. *The use of supplemental anchorage in the form of a mandibular acrylic tissue-borne device, as advocated by Bedell[26] and Moyers and Higley,[27] seems to provide an advantage.* It is claimed that these appliances provide stability by discouraging individual tooth movement and by including lingual tissue area for added resistance, Again, it is important that they be used prior to any tooth movement in the mandibular arch. Although Bedell states that, with this technique, he achieves satisfactory anchorage in about 90 per cent of his cases, my experience leads me to believe it to be not entirely satisfactory. This appears to be due to the personal equation and I am presently trying to work myself out of it. We should include in this category the Crozat removable appliance. Chapman's[28] "bite raiser" technique might be used in certain cases for a short time with elastics.

4. *Assisting in the preservation of anchorage by limiting the number of maxillary teeth to be moved at one time.* In this selective technique we may be able to use lighter pressures effectively and, hence, produce less anchorage

stress. The amount of elastic stress which may be tolerated before disturbance of mandibular teeth starts has been estimated to be about 85 grams (3 ounces) on each side, presuming that normal periodontal and alveolar tissue conditions are present. (This apparently is based upon Schwarz's[29] calculation in blood capillaries of 20 to 26 grams per square centimeter of surface.) Since, as MacEwan[30] states, we are dealing with variations (human tissue), this figure is variable and can be used only as a basis or starting point. Less than this pressure can be effective if we select one or more of the known measures designed to reduce the stress requirement.

An illustration of how effective this procedure may be is seen in the slow distal movement of one upper molar, a movement often attended by the induced distal movement of one or both premolars. If such distal movement is indicated and if we can treat the patient early enough, moving back the sixth year molar apparently also induces the premolars to erupt in good position—strong evidence for the desirability of early selective treatment. Useful devices for moving back these individual molars are the plain labial arch, the "Porter side hook," many kinds of "sliding yokes," and certain modifications of the Johnson, Universal, and edgewise appliances.

Another illustration of moving a limited number of teeth at one time might be cited in the use of the Johnson appliance in Class II, Division 1 cases in the maxillary arch. This ingenuous procedure, familiar to all, limits movement at first to the four maxillary incisors which, when moved distally and compressed against the mandibular incisors, tend to hold these teeth in position and at the same time influence the distal movement of maxillary molars as the second step. I have found this method to be particularly successful where there are spacing and forward tipping of maxillary incisors, since these can be tipped back under the influence of light pressure. As most of us know, the twin arch appliance is particularly successful also in Class II, Division 2 cases when mandibular anchorage is usually not a severe problem.

With any of the preceding techniques we might, of course, use multibanding in the mandibular arch, but if less stress is required simpler mandibular appliances might suffice. (If there is any recognizable original idea in this article, this may be it: "One is perfectly free to use any appliance or technique he wishes, depending upon circumstances, the age, the conditions present, the limitations posed by tissues, or economics."

5. *In cases in which the occlusal guide plane is indicated, its use greatly reduces the need for intermaxillary elastic pressure, since it positions the mandible, whether elastics are used or not.* Its inclined plane, however, does place a forward tipping stress on anterior mandibular teeth. This appliance is intended primarily to shift the mandible forward and "open the bite." It may be better, in many cases, to use an upper acrylic device with a flat plane to *encourage* growth forward, rather than to attempt to force it.

6. *In certain older cases in which the distal movement of molars is indicated and there is evidence of little posterior maxillary bone growth, the permanent maxillary second molars may be removed.* This should be done, of

course, only when the maxillary third molars are present and can be expected to erupt and take the place of the lost second molars. Such extractions are more desirable, in my mind, when we have either poor calcification of the second molars or extensive decay and when there is so little space that these teeth are already situated far buccally. We run the risk, in these cases, that the maxillary third molar may be defective or malformed, even though it appears to be normal under x-ray diagnosis. Third molars also may erupt in poor position, but generally one can guide them into normal relation. The anatomy of the third molar differs from that of the second molar and the resulting occlusion may require some grinding. Moreover, we must consider the presence or absence of the lower third molars and their position. If it appears certain that the lower third molars will be definitely impacted, we may remove the upper second molar, if indicated, with less hesitation. If we remove maxillary second molars we must prevent the overeruption of the mandibular second molars.

7. *Extraction of the two maxillary first premolars.* In some cases it may be advisable to extract the two maxillary first premolars, leaving the posterior teeth in a Class II relation and reducing stress on mandibular anchorage, since only the six maxillary anterior teeth need be moved distally. In actual practice, we may utilize intramaxillary anchorage by means of some method of stabilizing the upper posterior teeth, such as a palatal bar or an acrylic device. If we have good, stable second and first upper molars and second premolars and exert gentle distal pressure on the canines alone, we may find that we not only have satisfactory anchorage but that the incisors may, in turn, be influenced to move distally, provided that there is no interference and transseptal fibers are not abused. Some may include extraoral anchorage distal stress on the maxillary posterior segment but, to me, this does not appear to be good practice because this, in itself, produces tissue reactions unfavorable to tooth stabilization. It might well be used as a last resort, *after* rather than *during* distal stress on anterior teeth if positive intramaxillary anchorage has failed. Heath[31] claims that this maxillary extraction procedure will balance what he terms the "extrusive force" which tends to move maxillary posterior teeth mesially. Maxillary premolar extraction procedure is probably most advisable in cases exhibiting a high apical base difference, protrusion of the maxillary segment, and no spacing. Margolis[32] states: "There are some factors which contraindicate this procedure. For example, if the mandibular arch is crowded severely enough to warrant treatment, or if the overbite is severe and involves elevation of the mandibular posterior teeth, or if the entire mandibular arch is severely forward with marked precumbency of the mandibular incisors which might warrant attention." Leaving the posterior maxillary teeth in a Class II relation with those of the mandibular arch apparently satisfies the demands of health, function, and facial balance, especially if some equilibration is included during retention.

8. *Probably the most idealistic method of assisting or relieving mandibular anchorage stress lies in the use of some type of cervical or occipital appliance.*

Since, in a paper following this one, Graber of Northwestern University will discuss extraoral anchorage, remarks on the subject will be brief. Personal experience with this technique indicates that although one never knows just what it is going to do, it nearly always seems to help. In some Class II, Division 1 cases, for example, it may result in merely slowing down forward growth in the upper arch while giving the mandible a chance to grow forward. Its most important role, I have found, is its use with or without a maxillary bite plate (as Kloehn[33] recommends) in transition cases developing undeniable Class II tendencies. Actually, the bite plate probably may not permanently open the bite and is mainly useful to "unlock" the undesirable occlusion and give the maxillary posterior teeth a chance to move distally and may also encourage forward growth in the mandible. Particularly valuable is the fact that this technique offers us the chance to help patients at an early age without placing stress on a weak mandibular dentition. We must be careful, of course, not to "wear out" an originally "good" patient and then have to face a lack of cooperation later if standard appliances are needed to complete treatment. Another benefit derived from the technique is that, as Kloehn also recommends, we may use the simple cervical gear with its arch and side arms to eventually control distal tipping of molar crowns, although at the start of treatment such tipping may be desirable. Despite the fact that this procedure requires considerable cooperation, it is not really difficult and, in one form or another and in treatment of Class II and similar cases, it should greatly minimize the problem of mandibular anchorage.

Also, if we get children early enough, it is a very economical means of therapy. As a matter of fact, some cases may be reasonably successfully treated by means of this device alone. At any rate "to subject a case with mandibular arch in good alignment, no rotation, adequate arch length, and good axial inclinations to prolonged Class II elastic therapy would seem to be wrong if our ends can be accomplished in any other way."[34]

Before departing from the subject of extraoral devices, I should mention that they are often used in the maxillary arch for a short time to aid in retention. In addition in the mandibular arch, they are used for the purpose of preparing or bolstering anchorage and for the purpose of retention. An objection to these procedures, as previously stated, is that active pressure causes tissue reaction and therefore should tend to weaken anchorage and interfere with retention.

9. *We have mentioned the various mechanical means by which we might succeed in bolstering mandibular anchorage, but timing our selective orthodontic procedure is also important.* In cases in which Class II elastics are used during puberty—in other words, during a period of rapid growth—treatment time is shorter, condylar growth causing the mandible to move forward and downward. Perhaps the forward direction of mandibular growth helps reduce elastic stress. In those cases, however, in which the mandible is growing but is moving downward and in those cases in which mandibular growth in any direction is small, the problem of anchorage in Class II, Division 1 is acute.

Cephalometric radiography should aid in evaluating these cases. For example, if a high mandibular angle and an open Y axis are present, we might expect more vertical than horizontal growth, although forecasts of amount or direction of growth are, at present, debatable. I should also insert here the proposition that timing in connection with eruption schedule of teeth is important. An example is the easier distal movement of the maxillary first molar either before or after the eruption of the maxillary second molar, very preferably before. One notes that the optimum time for one orthodontic procedure is different from that of another. The only possible way to control the timing for these different procedures is to have the child under observation early.

10. *With younger patients, myofunctional therapy might result in some reduction of stress on the mandibular arch, and the control of certain abnormal tongue thrusting, mouth breathing, and other habits obstructing tooth movement may also be of assistance.* In addition to neuromuscular perversions, one must consider the pattern and dynamics of the muscles surrounding and directly or indirectly affecting the denture. The matter of relapse, for instance, in closed bite cases is probably due to violation of freeway space beyond the limits set by the muscles concerned. Other disturbances of the muscular balance in which malocclusions are found may cause similar relapse in either arch.[35]

11. *In some cases in which mandibular anchorage has failed in spite of reasonable precautions, we might finally resort in desperation to the extraction of one mandibular incisor, especially when otherwise the mandibular incisors and canines would be left in unsupported positions in the bone.* In cases which have discrepancies between maxillary and mandibular anterior tooth material, and when the Downs point B is forward of A, such extraction may be advisable. It may also be justified when functional deformities of the temporomandibular joint might be caused by too close an approximation of anterior teeth. Following such extraction, the remaining five anterior teeth can be moved into very good positions. This procedure should not be used except under the extreme conditions mentioned because of doubtful final occlusal relation with opposing anterior teeth. It should never be done for the sake of glamour alone, but it still seems better than the "disking" of mesial and distal lower incisor tooth surfaces recommended by some.

CONCLUSIONS

We have arrived at no particular conclusions except to point up the necessity for considering an exceedingly variable and often inadequate mandibular arch when used as anchorage in the treatment of Class II and similar conditions.

SUMMARY

If a case is one requiring mandibular anchorage, plan deliberately to protect that anchorage in the best way available for that particular case. In this worthy endeavor the following suggestions are offered:

1. In cases with deciduous teeth present in the mandibular arch, use little or no Class II elastic pressure. In treatment, consider extraoral anchorage.

2. In weak mandibular anchorage situations (if you can differentiate), plan to use every available precautionary measure to prevent disturbance of resistance units, including extraoral anchorage at least as a supplementary technique. Consider the various types of mechanics and choose the one which seems most suitable to the case in hand. If you are a lingual, labiolingual, edgewise, Johnson, Universal or Crozat man, do not hesitate to step across an imaginary boundary and use the mandibular appliance which common sense dictates is best for the case you are treating. Sectional treatment in the maxillary arch can result in lighter stress on mandibular anchorage, and that stress for a shorter time. Directing major tooth movement *through* cancellous bone channels, rather than *against* compact areas, should also reduce stress requirements. Plan to move only those teeth that must be moved. Normal shift of individual teeth may be expected following the development of space provided by movement of other teeth or following the removal of interference.

3. In selected cases, reduce mandibular anchorage hazards by extracting maxillary second molars or maxillary first premolars.

4. During retention, continue to observe tendencies for disturbance in the mandibular arch whether due to treatment or to natural causes. Probably most cases should have equilibration by either the qualified orthodontist, a qualified general dentist, or a periodontist. Note particularly whether the mesiolingual inclined plane of the maxillary canine is striking the distobuccal inclined plane of the mandibular canine, either in occlusion or in excursions of the mandible. This might cause mesial tipping of mandibular canines and crowding of mandibular incisors. If unable to prevent considerable crowding by any available means, it may be desirable under the conditions previously mentioned to extract one lower incisor.

5. Time the various steps in treatment, if possible; early for some procedures, later for others. Since mandibular growth usually picks up in puberty, use elastic therapy in Class II cases during this stage of growth if possible. Time for a younger age in girls than in boys, for growth in boys is not only later but more prolonged. As our knowledge of the growth of the denture and the surrounding parts gradually increases, we probably will pay more attention to circumventing the abnormal and aiding and abetting the normal than to mechanical devices. Indeed, some are already "guiding growth" as it were, with the perhaps more knowledgeable use of the simple appliances of yesteryear —notably, such devices as bite plates and cervical gear.

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1746 K ST., N.W.

PRESENTATION OF THE ALBERT H. KETCHAM MEMORIAL AWARD, 1955, BY RAYMOND L. WEBSTER, PRESIDENT OF THE AMERICAN BOARD OF ORTHODONTICS

Mr. President, Dr. Johnson, Fellow Directors of the American Board of Orthodontics, Members of the American Association of Orthodontists, and Guests:

Since 1937, when the first Albert H. Ketcham Memorial Award was made, fourteen men, who in the judgment of the Award Committee have made notable contributions to the science and art of orthodontics, have been its recipients. Although the list of these men is given in the Booklet of Information of the American Board of Orthodontics, I think it would be proper at this time to read their names so that our pleasant memories of those outstanding men might be refreshed. As their names are read, we who have been fortunate enough to know them will connect each man with some outstanding phase of orthodontics which he developed. When we put all those accomplishments together, we have pretty much the history of orthodontics to the present time. The fourteen men who have received the Albert H. Ketcham Memorial Award from 1937 through 1954 are: John V. Mershon, Alfred B. Rogers, Milo Hellman, George W. Grieve, Frederic B. Noyes, Harry E. Kelsey, B. Holly Broadbent, Raymond C. Willett, Clinton C. Howard, William K. Gregory, Benno E. Lischer, James D. McCoy, Spencer R. Atkinson, and Charles R. Baker. Today we are adding another name to that honored list—the name of a man known throughout the land for what he has done in the development and teaching of one of our accepted appliance therapies.

Joseph E. Johnson is descended from early Maryland settlers who moved to Kentucky shortly after the Revolution. He was born in Waverly, Kentucky, Aug. 16, 1888, to Dr. Joseph E. and Catherine Spalding Hite Johnson. He was the fourth son in a large family of eight boys and one girl. Joe received his education in the local schools and, upon completing his high school course at St. Mary's College in Kentucky, he studied engineering at the University of Kentucky for two years.

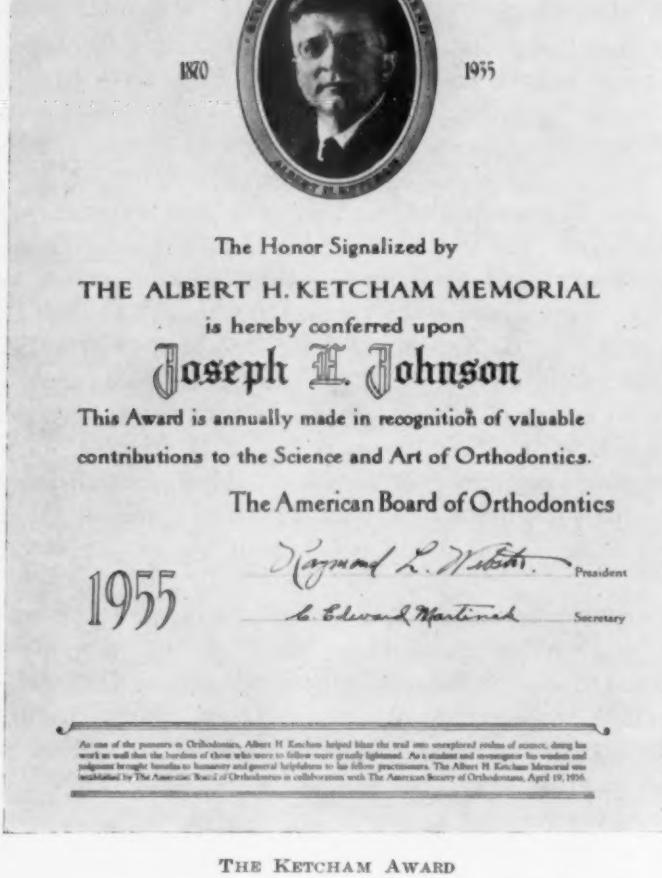
In the fall of 1908 he began the study of dentistry in the Louisville Dental College, then a department of Centre University. Following his graduation in 1911, he engaged in general practice for two years and, upon completing a course in orthodontics under Dr. Martin Dewey in 1913, he immediately returned to Louisville and entered the specialty of orthodontics, which he has continued ever since.

With his pioneering inheritance, plus his early engineering training, Joe immediately set out to improve the methods of appliance construction then in

Presented at the fifty-first annual session of the American Association of Orthodontists, San Francisco, California, May 9, 1955.

use; and only six years after entering the specialty he introduced the loop molar band. His attention was next turned to arch predetermination, and one year later, in 1920, he presented what he termed a simple method of determining malocclusion with amalgam models.

Being dissatisfied with the rigidity of the appliances then in use, he next set about to develop an appliance which, through its resiliency, would always be gentle, yet strong enough to move teeth and bring about an arch form, which his previous method of predetermination had dictated.


1870 1955

The Honor Signalized by

THE ALBERT H. KETCHAM MEMORIAL

is hereby conferred upon

Joseph E. Johnson

This Award is annually made in recognition of valuable contributions to the Science and Art of Orthodontics.

The American Board of Orthodontics

1955

Raymond L. Webster President

C. Edward Martinek Secretary

THE KETCHAM AWARD

In 1929 he introduced an appliance which has been synonymous with the name of Joe Johnson—the twin wire mechanism. Six years later he developed an adjunct to the twin arch, the tubular and staple lingual arches.

During these first twenty-two years of orthodontic practice, he had spent nights and Sundays at the office carrying out his experiments, and it was not until each appliance had been tried and tested that he introduced it to his confreres.

In October, 1921, Dr. Johnson married Elizabeth Crecelius, and they have been blessed with two daughters—Mrs. Theodore Fowler and Miss Barbara Lee Johnson—and two grandchildren.

In 1937, Joe gave his first lecture course at the University of Michigan. Since then he has given two courses at the Atlantic Southern Dental School, fourteen at Columbia University, six at Washington University in St. Louis, two at the University of Montreal, two at the University of Pennsylvania, two at the College of Physicians and Surgeons in San Francisco, one at the University of Havana, and one at the University of Alabama.

During these courses in the past eighteen years, over 700 orthodontists from forty-three states of the Union and from many foreign countries have received the benefit and most thoroughly enjoyed the teachings of Dr. Joseph E. Johnson.

—Walton Jones, Louisville, Ky.

JOSEPH E. JOHNSON

Also during these years, Dr. Johnson has read papers before nearly every orthodontic society in this country. Color photography has now taken the place of black and white in preparing slides to accompany papers read at scientific meetings, but nowhere has it been used as long as, or more effectively than in Joe Johnson's courses and in papers that he has read. The preparing and tabulating of the vast amount of material which Joe employs in illustrating, with color transparencies, the step-by-step progress, from beginning to end, of countless cases of every category of malocclusion represents many, many hours of work during his daily practice.

In presenting his material, Joe, in his inimitable way, sometimes makes it all look very simple, but one attending his lectures soon realizes that here is the originator and master of this appliance technique. With Joe's ability to carry out his appliance therapy expeditiously, he has been able to make orthodontic treatment available to vast numbers of worthy and deserving patients.

Dr. Johnson has been honored by the following university appointments: lecturer in dentistry at Columbia University; visiting lecturer in Orthodontics at the Graduate School of Medicine, University of Pennsylvania; visiting lecturer at Washington University in St. Louis; honorary professor at the University of Montreal; and visiting professor at the University of Havana. He is an honorary member of the Cuban Association of Orthodontists, a diplomate of the American Board of Orthodontics, fellow of the American College of Dentistry, past president of the Southern Society of Orthodontists, past president of the American Association of Orthodontists, and honorary president of the Johnson Alumni Club. While in dental school, he was a member of Psi Omega fraternity and he was also elected a member of Omicron Kappa Upsilon honorary fraternity.

This record certainly bespeaks the fact that in Joe Johnson we have a man who, through his perseverance, talent, ability, and willingness to pass this along, has been one of our great benefactors to the public, the profession of dentistry, and to the specialty of orthodontics.

And now, by virute of the power vested in me by the American Board of Orthodontics, it is my particular pleasure and honor to bestow upon you, Joseph Ebert Johnson, the Albert H. Ketcham Award for the year 1955.

RESPONSE BY JOSEPH E. JOHNSON TO THE PRESENTATION OF THE ALBERT H. KETCHAM MEMORIAL AWARD

Dr. Webster, Members of the American Board of Orthodontics, Members of the American Association of Orthodontics, Ladies, and Gentlemen:

I feel that I am a very lucky person, not only to have been given this award, but because it was my good fortune to have begun my orthodontic career at the start of the profession's renaissance.

It is my privilege to have known most of the leading pioneers in orthodontics —the men who put our specialty on the high plain where it stands today, such men as Lloyd Lourie, J. Lowe Young, Pullen, Kelsey, Ketcham, and many others. I have had the pleasure of working with most of them, and I feel that these stalwart men really laid the foundation of our orthodontic practice as it stands today.

I wish to thank the officers of the Association and the Members of the American Board of Orthodontics for conferring this high honor upon me. It makes me feel as though my poor efforts have been not entirely unappreciated. I hope that this inspiration will continue with me through the remaining years of my life, and that I may always work for the high ideals of our profession.

Editorial

Cephalometrics, Cephalometrists, and Orthodontics

THAT cephalometrics is changing the orthodontic perspective, no one will deny. Yet, the greater segment of clinical orthodontists are hard put to follow with a sufficient degree of accuracy the discussions of investigators in this field. Many orthodontists freely admit their failure to grasp the technique, if not also the practical value, of the application of cephalometrics in their daily practice.

At the fifty-first annual session of the American Association of Orthodontists in San Francisco, which closed on May 12, 1955, cephalometrics was the underlying theme of practically every one of the essays and most of the research reports presented. Articles on cephalometrics now constitute the vast majority of papers submitted for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Were the JOURNAL to attempt to publish all these contributions, the editor would find the space available to him pre-empted by this subject for months to come and the readers of the JOURNAL would find themselves hopelessly confused.

Lest the uninitiated practitioner become discouraged when he reads articles or sits at meetings and listens to supercharged statistical discussions that would tax the faculties of the specialist in biostatistics, we quote briefly from the field of physical anthropology.

Le Gros Clark, professor of anatomy at the University of Oxford, England, a well-known authority in paleoanthropology, calls attention, in his recent book,* to the fallacies which occur in the quantitative assessment of taxonomic relationships. Clark includes the following of interest to orthodontists:

1. "The fallacy of relying on inadequate statistical data."
2. "The fallacy of treating all metrical data as of equal taxonomic value."
3. "The fallacy of treating characters separately and independently, instead of in combination."
4. "The fallacy of inadequate or inaccurate statistical treatment."
5. The fallacy of failure to adhere to "the principle of morphological equivalence in making statistical comparisons."

*Le Gros Clark, W. E.: The Fossil Evidence for Human Evolution, An Introduction to the Study of Paleoanthropology, Chicago, 1955, The University of Chicago Press.

6. "The fallacy of comparing skeletal elements in individuals of different age, sex and size."

7. "The fallacy of comparing measurements taken by different observers using different techniques."

8. "The fallacy of relying for assessment of affinities on biometrical analysis of characters which may have no genetic basis."

If the foregoing fallacies can be avoided, the next question is: What are we measuring and what is the significance of such measurements? Kherumian,* a physical anthropologist, submits a table of craniometric and anthropometric measuring points, to which he adds: "It is necessary to prescribe a system of exact landmarks which will permit searching analysis of human morphological characters, as much for the skeleton as for the soft parts. Such a system of 'morphologic points' does not exist . . . it remains for a future Congress of specialists to eliminate superfluous points and harmonize others."

Björk, one of the outstanding contributors to the study of cephalometrics, and Palling** caution the orthodontist who would rely on cephalometrics as follows:

"The value of biometrical methods in clinical diagnosis depends entirely on the user's appreciation of the limitations inherent in the method. Cephalometric methods of analysis, especially growth analysis, can be extremely valuable but presuppose a thorough knowledge of normal and anomalous growth and development and how to interpret biometrical methods. Failing this, such methods may prove difficult to understand and may even be misleading."

The biometric study of large numbers of children through cephalometric methods has provided us with an insight into the human growth pattern of the face and jaws. Attempts also have been variously made to employ cephalometric findings as diagnostic criteria. The question now arises as to how valid are cephalometric measurements in planning diagnosis. Lundström*** is of the opinion that "the clinical importance of cephalometric determinations is a question that cannot be considered sufficiently investigated."

Perhaps the major point of agreement among the cephalometrists on this side of the Atlantic is the fact that clinical diagnosis along cephalometric determinations entails the weighing of many measurements which tend to modify each other and may even cancel out their respective contributory significance in the evaluation of the facial pattern as found in the individual patient.

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*Kherumian, R.: Répertoire des points cramometriques et anthropométriques. Rev. Morpho-Phelpiologie Humaine, No. 2, p. 22, 1949 (Abstracted in Am. J. Phys. Anthropol.).

**Björk, A., and Palling, M.: Adolescent Age Changes in Sagittal Jaw Relation, Alveolar Prognathy, and Incisal Inclination, Acta Odontol. scandinav. 12: 201-232, 1955.

***Lundström, A.: Cephalometric Registrations as an Aid in Diagnosing Malocclusions. Angle Orthodontist 24: 8-14, Jan., 1954.

In a recent paper,* we called attention to the fact that the important element which is still lacking in so far as the use of cephalometrics as positive diagnostic criteria in orthodontics is concerned, is a "normal range" of values about the various standard mean measurements employed, to be used as a *base line*. The use of mean measurements as diagnostic bases can be dangerous and the significance of standard deviations frequently is confusing to the practitioner who is not too familiar with the statistical method.

We also pointed out, in the same paper, that any measurements obtained in an individual child which fall outside the standard "normal range," when such is established, would then have to be associated with an abnormal condition of dentofacial growth and malocclusion of the teeth and should not be found in association with normal dentofacial growth and normal dental occlusion.

Since the various lines and angles measured in cephalometric studies are known to exhibit an extremely wide range of variation about their mean, it becomes an almost insurmountable task to evaluate their relative diagnostic significance. The situation, however, is far from a hopeless one. To the contrary, it holds forth much promise for the orthodontics of the future. Whether this future promise will be realized depends largely on the initiative of the orthodontists themselves.

What is needed is a common meeting ground on which representatives of the various disciplines concerned would study the cephalometric problem to formulate basic principles as a guide to workers in this field and to establish criteria for testing findings so obtained.

We do not refer to holding a "symposium," where each of the participants is anxious to defend his thesis. It is proposed, rather, that a "workshop" be held. Among those who might be invited to such a "workshop" should be physical anthropometrists, biometricians, anatomists, and orthodontists. The persons invited should be briefed in advance and given time to prepare statements; their statements should be studied by the participants before the "workshop" is convened. The report emanating from such a group could not be expected to bring about a complete and immediate solution of the problem, but it would certainly go a long way toward bringing about a better understanding of the problem itself. For the practitioner of orthodontics, it would provide a point of orientation which would aid him in understanding and applying cephalometric findings. The American Association of Orthodontists might well consider the foregoing suggestion one of its responsible concerns.

J. A. S.

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*Salzmann, J. A., and Ast, D. B.: The Newburgh-Kingston Caries Fluorine Study. IX. Dentofacial Growth and Development—Cephalometric Study, Am. J. Orthodontics **41**: 674-690, 1955.

The Jenkins-Keogh Bill

DESPITE the fact that about 45 million persons now have coverage under Social Security, certain professional groups (including dentists) do not have coverage. Many professional men, preoccupied with their work as a group, seem to have been slow to realize just what this coverage adds up to in the long course of a life's span and what it is all about.

Something new in old-age pension plans is being advocated now for physicians, dentists, farmers, attorneys, small business men, and other self-employed persons. The idea seems to be to allow this group to put aside some earnings each year (tax-free) in a special retirement fund or annuity. This will relieve self-employed persons of some of the disadvantages they have suffered in comparison with the provisions made for employed persons to accumulate retirement benefits.

Professional workers in business for themselves are at a serious tax disadvantage because there is no retirement system. They can use part of their income for annuities, but they secure no tax exemption for that income. The result plainly is that the self-employed person finds it difficult to make provision for his old age, income notwithstanding, because it is difficult to set aside taxed income.

The Administration, it is true, has under consideration Social Security coverage for millions of self-employed professional persons still not covered. That is good, but many contend that Social Security benefits alone are too small to give a high-income person a standard of living anywhere near that to which he has been accustomed during his active years.

Employees get tax freedom for deferred income paid into retirement funds in addition to Social Security. The professional people want the same treatment.

The American Bar Association has approved the Jenkins-Keogh bills and earlier versions of these bills, and has urged their adoption in Congress.

The bill, H. R. 10, went to the House of Representatives about the middle of July. The Ways and Means Committee of the House of Representatives, and congressmen in general, should be made aware that the dental profession is vitally interested in the passage of this bill.

H. C. P.

Reports

REPORT OF THE COMMITTEE ON THE PRESIDENT'S ADDRESS, AMERICAN ASSOCIATION OF ORTHODONTISTS, 1955

THE committee appointed to review the President's Address takes pleasure in approving all the recommendations of your president.

First, we wish to join in his compliments to the various officers and committeemen who have given of their time, thought, and energy to make this meeting so outstanding.

We also wish to agree with him in his complimentary remarks regarding Dr. Joseph E. Johnson, the recipient of the Ketcham Award; the Publication and Editorial Board and our editor, Dr. Pollock; the work of the chairman of the Research Committee, Dr. Salzmann; and also Dr. Vernon Fisk, chairman of the Necrology Committee.

We thoroughly agree with President West that definite plans should be established to improve methods whereby patients may be transferred from one orthodontist to another. We recommend that the president be authorized to appoint a committee to study this matter and report to the Board of Directors.

Our president particularly praised the work of our secretary, Dr. Franklin A. Squires, and recommended that a special study be made in regard to the duties of the secretary-treasurer. We are informed that since the President's Address was written a special committee from the Board of Directors was appointed to study this matter. This report has been given to the Board and their recommendations should solve many of the problems involved.

Our president has very appropriately mentioned that the first president of this Association, who was known also as the "Father of Orthodontics," was born just 100 years ago, on June 1, 1855. We most heartily agree that suitable resolutions should be drawn up to memorialize Dr. Edward H. Angle on his centennial and that a copy of these resolutions be sent to the surviving widow as a token of our appreciation to our first president for his many accomplishments in starting and guiding the early days of the orthodontic profession, which has resulted in its present-day state of progress. It would be our recommendation that our president be authorized to appoint a suitable committee to draw up these resolutions.

In the President's Address, Dr. West has stressed particularly the importance of studying the proposed amendment to our bylaws, which defines new requirements for election to active membership in this Association. Your Committee agrees that this is a change which must be studied carefully before

its adoption by the membership. While we believe that university training is unquestionably a most desirable requirement in a specialty, we also believe that we should consider very carefully whether our specialty is ready for this requirement at this time and, if so, whether we should also have another type of membership with lower educational requirements until the universities may have more standardized orthodontic curricula and also greater facilities for accepting a larger number of students in orthodontics.

We wish to commend Dr. West on his very splendid President's Address and to thank him and his officers and committeemen for the wonderful job they have done to make our meeting in California not only most enjoyable, but also exceedingly profitable.

Respectfully submitted,
G. A. Devlin,
Brooks Bell,
Lowrie J. Porter, Chairman.

ANNUAL REPORT OF THE MILITARY AFFAIRS COMMITTEE, AMERICAN ASSOCIATION OF ORTHODONTISTS, 1955

THE Military Affairs Committee wishes to divide the report of its activities into two sections: (1) an account of its contact with the Armed Services concerning a resolution of the Board of Directors of this Association and (2) an analysis of the present situation as it relates to the induction of dentists into the Armed Services.

As instructed by the Board of Directors, the Military Affairs Committee brought to the attention of the Armed Forces the resolution which was adopted by the Board at its annual meeting last May. This resolution asserted the opinion that orthodontists who have been inducted from private practice into the Armed Services, and whose specialized skills cannot be used for treatment of military personnel, should practice general dentistry. The tenor of the replies received from the dental services of the three main branches of the Armed Forces was generally cordial and, for the most part, indicated the desire to cooperate, if possible. Representative of the views expressed were the following excerpts from these replies:

> The Navy Department stated, in part: "At the present time, the Naval Dental Service, by regulation, is not permitted to practice orthodontics. . . . Because the Dental Service knows the urgent needs of its active duty members, and recognizes that only the more urgent treatment can be taken care of with our present ratio of two dental officers per 1,000 troop strength, the limitations of dental treatment, particularly as they apply to orthodontics and dependent care, are complied with strictly."
>
> The Air Force's letter contained this comment: "The spirit and intent of the 'Dependent Medical Care Act' now being considered

by Congress authorizes complete dental care, when practicable, for dependents overseas and in remote areas of the continental U. S.; elsewhere, dependents are authorized emergency dental care only. Concordantly, the Air Force proposes to utilize the major portion of its orthodontic personnel strength in oversea theaters. This must not be construed that orthodontists will be used exclusively for dependent care, as dental staffing is predicated against military strength served."

The reply from the Department of the Army was noncommittal, but advised: "Copies of your letter have been made available to the Dental Surgeons of the Continental United States Armies, the Military District of Washington, General Hospitals in the United States and to the Overseas Commands."

In regard to its activities on behalf of the members of the Association, this Committee is pleased to relate that, despite previous indications, certain of the difficulties which had been expected this year failed to materialize. Whereas a rise in the rate of induction of dentists into the Armed Forces had been threatened, the pace actually seemed to slacken, at least during the first half of the fiscal year which began in July. That is to say, calls to service have proceeded at a speed somewhat less than that normally required to maintain the strength of the dental service for the peacetime forces. Within the last few months, however, a substantial number of prospective dental officers have been alerted for duty. Since the ratio of orthodontists to the total number of dentists throughout the country is rather low, it follows that a similar proportion exists among those eligible for induction. Thus, it is not surprising that requests for assistance and advice were received from only six members of the Association. Of these, two had anticipated such a call long ago and consequently were more or less prepared, one was already in the Reserve and thus beyond the reach of this Committee, and the others merely sought to clarify the present situation as it affected them.

The real problem which looms ahead, however, lies in the fact that the group of dentists who make up Priority III (those who were exempted during World War II and others who have had no service) is rapidly being consumed. It is this category, of course, with which we are primarily concerned, since it includes all eligible orthodontists who have never served on active duty. For replacement of the 1,500 dental officers whose tours of duty are being completed this year, only an estimated 900 members of the graduating classes of the dental schools will be available for military service. Thus, the deficit of 600 must necessarily come from civilian ranks. At the present time, those in Priority III up to and including the age of 44 are already being called, as was anticipated by this Committee in its report last year. Future calls may reach an age group which the Services had always hoped to avoid tapping.

The much-publicized plan for reduction in size of the Armed Forces, which was announced by the President only a few months ago, must not be expected to alleviate the current situation. The American Dental Association has taken a strong stand in this matter by trying to restrict the number of

the dental inductions to the minimum immediately. However, it must be recognized that such a drastic general reduction of military personnel must necessarily be gradual, probably requiring nearly two years for completion. Thus, it is not likely that the demand for dental officers as replacements will soon be as sharply reduced as the A. D. A. contends.

Another critical situation has been created by the imminent expiration of the so-called Doctor-Dentist Draft Law. President Eisenhower has urgently requested its renewal, and Congress is now studying the matter very carefully. Although the A. D. A. has voiced opposition to the law this time, it is difficult to understand how the dental care requirements of the Armed Services can be met without some form of legislation.

Even after the reduction of the military forces has reached the ultimate level for standby purposes, it is obvious to all who have the best interests of this country at heart that it would be foolhardy, in these days of world tension, to allow the size of the Armed Forces to diminish to the point reached prior to World War II. Since the dentist is an essential cog in the mechanism, relative strength of the dental services must be maintained. Whether the output of the dental schools will be sufficient to fill this demand is unknown. If the need can thus be met by recent graduates, the procurement agencies will, without a doubt, be agreeably surprised. It is manifestly uneconomical as well as troublesome administratively to press into service men long in professional life, while younger dentists are available. Only when the latter group is inadequate in number is Selective Service forced to turn to the one group which can, in fairness, be asked to fill the breach—those who have never served before. Thus, it should be expected that some members of the A. A. O. will continue to receive calls to active duty for some time in the future, even under peacetime conditions.

Respectfully submitted,
Paul V. Reid
W. Robert MacConkey
William H. Oliver
Marion A. Flesher
D. Robert Swinehart, Chairman

March 30, 1955.

Department of Orthodontic Abstracts and Reviews

Edited by
Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Adolescent Age Changes in Sagittal Jaw Relation, Alveolar Prognathy, and Incisal Inclination: By Arne Björk and Mogens Palling. *Acta odont. scandinav.* **12**: 201-232, February, 1955 (A digest).

The object of the article is to examine the mechanism behind the age changes in sagittal occlusion. The material is derived from measurements made on lateral head x-ray exposures of 243 12-year-old Swedish boys who were re-examined by the same method at the age of 20. This study thus covers the adolescent developmental period.

The authors divided the factors which determine the variation in sagittal incisor occlusion as follows:

1. Maxillary alveolar prognathism (pr-n-ss = prosthion-nasion-subspinale).
2. Mandibular alveolar prognathism (id-n-pg = infradentale-nasion-pogonion, and CL/ML = the chin line from infradentale through pogonion related to the mandibular plane).
3. Maxillary incisor inclination (IL_s/OL = maxillary incisor axis related to the occlusal line, that is, incisal edge of the maxillary incisor to the tip of the distal cusp of the maxillary first molar = maxillary incisor axis related to the nasal line through the spinal point and pterygomaxillare).
4. Mandibular incisor inclination (IL_i/OL = mandibular incisor axis related to the occlusal line, and IL_i/ML = mandibular incisor axes related to the mandibular plane).

5a. Sagittal jaw relation (ss-n-pg = subspinale-nasion-pogonion, and ar-pgn and (ar-ss) = difference in length of line articulare to subspinale and line articulare to prognathion).

5b. Sagittal apical base relation (ss-n-sm = subspinale-nasion-supramentale; the inferior-posterior angle formed by OL, the occlusal line and a line through subspinale and supramentale, and the difference in length of line ar-sm = articulare to supramentale and articulare to subspinale).

Mandibular prognathism, on an average, increases somewhat in relation to the maxilla, causing the profile to straighten and the mandible to become more protrusive.

Because the age changes in facial prognathism vary considerably from person to person, and as the differential displacement of the jaws may occur

in either direction, individual deviations from the general growth pattern may be considerable. It should be noted, in this connection, that neither the age changes in the various facial angles of prognathism nor the sagittal jaw relation shows any statistical evidence of a significant relation with the type of sagittal occlusion present at the 12-year stage or when the sagittal occlusion is expressed in terms of overjet or molar occlusion.

The development of the facial prognathism and the sagittal jaw relation during adolescence, therefore, appears to be independent of the sagittal occlusion type found at the 12-year stage.

Development in length of the face does not appear to be related to the occlusion type. No interconnection has been found between age changes in the sagittal jaw relation, expressed in terms of linear differential facial length, and the sagittal occlusion type at the age of 12.

The variation in alveolar prognathism found for the ages of 12 and 20 years is greater in the mandible than in the maxilla. Individual age changes are found to occur in either direction and these are also greater in the mandible. Hence, the alveolar prognathism varies more in the lower jaw, in all respects.

Age changes amount to between 70 and 90 per cent of the variation in shape at the age of 12, and indicate that the development of the alveolar arches does not depend merely on the general variation in growth which characterizes the cranial development as a whole, but, in addition, exhibits a pronounced modification of the shape during the growth period in question, affected by the formative influence exerted by the muscular function of the lips and tongue or by some extraneous factor.

Pronounced alveolar prognathism in the upper jaw at the age of 12 will be found, on an average, to diminish in time, whereas if the degree of alveolar prognathism is small, an increase will occur. It will be seen from this that the general tendency in the case of wide deviations in either direction is toward a compensating development.

The inclination of the incisors has been determined in relation to both the occlusal line and the base of each jaw. The variation in inclination for both age groups is found to be wider than for any other components of the bite studied. As both the occlusal line and the lines representing the jaw bases alter position with age, it has been found practical to employ both methods of registration. The variations show a definite, but slight, tendency to increase with age.

The average age change in the inclination of the incisors was found to be comparatively insignificant, with a tendency for the angle formed by longitudinal axes of the upper and lower incisors to widen with age.

Individual age changes are known to occur in either direction. The range of variation for these individual changes is remarkably wide.

The shape of the dental arches, in similarity to that of the alveolar arches, is intimately dependent on the formative influence of functional forces active during the growth period, the effect of which is a more or less strongly pronounced modification in shape occurring with age. This means that incisors with a pronounced inclination, facial or oral, show a marked tendency to straighten during the developmental period, and individual age changes in the inclination of the incisors occur in both a compensatory and a dysplastic direction.

Age changes in the sagittal jaw relation are accompanied by secondary changes of a compensatory nature in the alveolar and dental arches. This appears to be the result of pressure exerted by the lips and tongue, which tends

to maintain the bite form, while development is causing a sagittal displacement between the upper and lower jaws. By correlative calculations between the age changes of the five components measured, it is possible to obtain some indication of the average effectiveness of this compensatory influence. In certain cases, however, the dysfunction of the lips and tongue has the effect of inhibiting the compensatory changes, wholly or partially. This is one of the factors which reduce the correlation.

The dysfunction of the lips and tongue in various functional connections and special habits, such as lip-biting, thumb-sucking, etc., have long been considered as modifying factors in influencing the shape of the bite. Dysplastic modifications of this kind may be expected, on the whole, to appear independently of skeletal age changes and not to affect the development of the basal jaw arches appreciably. Here the intercorrelation between the various components of the bite would also serve to indicate the extent of the modifications, provided that the compensatory variation could be excluded.

Compensatory and dysplastic variations tend, more or less, to cancel each other out with age, which greatly complicates any study of the development of the bite. A significant correlation between the age changes of two bite components may be interpreted as a preponderance of either the compensatory or dysplastic changes, according to the direction indicated by the correlation. Absence of any correlation implies approximate equality of the compensatory and dysplastic factors and that, hence, on an average, they have cancelled out. Taking the age changes in the sagittal jaw relation as a starting point, it will be found that compensatory changes in the bite occur in the alveolar and dental arches in both jaws. The more the mandible becomes retruded with age in relation to the maxilla, the lesser becomes the alveolar prognathism in the upper jaw and the greater the alveolar prognathism in the mandible. This is accompanied by a deviation in oral direction of the upper incisors and by a facial inclination of the lower incisors as measured to the jaw bases. Any change of the sagittal jaw relation in the opposite direction (that is, toward increased protrusion of the mandible relative to the upper jaw) results in compensatory changes opposite to those described.

The compensatory modifications within the alveolar and dental arches are more pronounced than the dysplastic changes and they are somewhat greater in the mandible.

Compensatory dento-alveolar changes predominate during adolescence. The variations in the dento-alveolar components which occur in adulthood thus are found to be mainly of a compensatory nature. Retruded position of the mandible in relation to the maxilla in adults is accompanied by pronounced alveolar prognathism of the mandible and facial inclined mandibular incisors, whereas the maxillary alveolar prognathism is somewhat reduced. The variation found in the inclination of the maxillary incisors depends about equally on compensatory and dysplastic factors at this age.

The combination of compensatory and dysplastic modifications of the bite varies with the individual person, and a study of the individual growth pattern will provide the desired information as to which factors are predominant in any given case. Any analysis of the effect on the tooth position of the dysfunction of lips and tongue and the influence of individual habits such as thumb-sucking, etc., must be carried out with due regard to the concurrent changes of a compensatory nature resulting from the growth changes of the jaw structure.

Age changes in the sagittal jaw relation are of great importance in the development of the sagittal occlusion. However, the displacement in occlusion that results from this is not proportional to the displacement of the

jaws; it is considerably smaller. This is explained by the compensatory changes in incisal inclination or alveolar prognathism in either or both jaws with age, as discussed previously.

The compensatory mechanism is thus to reduce the correlation between the age changes in sagittal jaw relation and the age changes in overjet. The importance of the compensatory effect in this connection may be demonstrated by calculating the partial correlation, eliminating the age changes in the incisal inclinations in both jaws, by which calculation the correlation increases.

The mutual correlation between the age changes in overjet and the age changes in incisal inclination is lower, but nevertheless significant.

The changes in sagittal jaw relation which occur during adolescence exercise greater influence on the development of overjet than do the dysplastic changes within the alveolar and dental arches.

Extreme maxillary overjet in the 12-year-old boys is generally accompanied by a facial (dysplastic) inclination of the upper incisors. The variation in the inclination of the maxillary incisors at this age thus is determined mainly by dysplastic factors. During the remaining growth period, up to adult age, the situation undergoes a change. At the age of 20, the compensatory and dysplastic variations cancel out within the maxillary alveolar and dental arches. In the mandible, on the other hand, the alveolar prognathism, expressed in terms of the chin angle, increases in the case of extreme maxillary overjet as a result of compensatory influence, while the incisors of the same jaw suffer a forward inclination. Thus, at adult state, the dental and alveolar arches are generally of a compensatory shape.

It should be noted, however, that the correlation calculations quoted should be regarded only as indicative of the quantitative relationship. As far as the individual person is concerned, however, all the components are of importance in the development of overjet.

The question of the extent to which the frontal modeling may be transferred to the side segments of the dental arches, affecting the dental arch shape as a whole, cannot be answered clearly from this study. In the individual, the reaction seems to be very different. Early extraction (for instance, of a deciduous canine) may result, at least in some cases, in a reduction of the alveolar prognathism and consequently impair the change of normal development of the alveolar arches, especially in the lower jaw. For this reason, the extraction of deciduous teeth as a method of correcting crowding does not appear to be very well justified, if not considered in relation to the individual growth pattern.

Correlative studies of dental arch development are of limited value due to the interaction of dysplastic and compensatory modeling of the dento-alveolar arches in all dimensions.

A better understanding of this problem should naturally require an analysis of the individual development as related to the actual skeletal growth pattern and the function of the soft tissues.

From a clinical point of view, the registration of the apical base relation has come into widespread use in recent years. Due to dysplastic and compensatory modifications in alveolar arch form, the apical base section will follow a different pattern of development than the sagittal jaw relation. This differential development is of importance in growth analysis.

The conclusions may be summarized briefly as follows:

Individual variation occurring with age in the facial component is proportional to the individual age variation in the facial structure and cranial base as a whole, and is termed the general age variation. As a result of the formative influence of the functional factors, the dento-alveolar components

exhibit an individual age variation considerably in excess of the general age variation, which shows itself as a modification in shape. This variation is of both a dysplastic and a compensatory nature.

The development of the facial component appears to be independent of the development of the dento-alveolar components. The latter are, in their turn, intimately dependent on the development of the facial component, the sagittal jaw relation. The modification occurring in the dento-alveolar components due to adolescent development is mainly of a compensatory nature.

Abstracts Presented Before the Research Section of the American Association of Orthodontists, San Francisco, May 11, 1955

An Evaluation of the Effects of Bulbar-Spinal Poliomyelitis on the Occlusion of the Teeth: By Robert G. Daniel, A.B., D.D.S., Sierra Madre, Calif.

Before 1948, the mortality rate of all persons stricken with respirator type poliomyelitis was 41 per cent. Since 1953, in the Los Angeles area, the mortality rate for this same type of poliomyelitis has been reduced to 12 per cent, due to the use of the tracheotomy, a better understanding of the respirator, and a more efficient handling of the patient's needs. For such a great reduction in the loss of life, it is extremely important for everyone concerned to work as a team.

Because the patients with bulbar-spinal poliomyelitis may not be able to cough or swallow, oral hygiene could become a problem. With patients of this type, the gingival tissue is red, swollen, and irritated. A very high percentage of these patients are fed by Levin tube.

Study models and cephalometric x-rays reveal that the young patients generally tend toward a protruded maxilla with a procumbency of the anterior teeth, while the mandible seems to be retruded, with a lingual collapse of the anterior teeth. With very few exceptions, the adult patients having the same type of poliomyelitis show no perceptible tooth movement. Scoliosis is a constant threat, and may account for the rapid tooth movement among the young patients. Conversely, the adult patients may show very little malalignment of the teeth because they have completed their growth.

To date, it is not known whether the bony structures will permit orthodontic movement, or even retention of the teeth. These questions may be answered in the near future.

A Cephalometric Evaluation of the Facial-Skeletal and Dental Changes During and After Treatment of Class II, Division 1 Malocclusion: By James L. Thurston, B.S., D.D.S., Oakland, Calif.

Material and Method.—Serial lateral cephalometric roentgenograms from twenty-seven treated Class II, Division 1 malocclusion cases were studied. Roentgenograms were taken for each patient at each of the three stages of study representing before treatment, after treatment, and after retention. Eight cases were treated by nonextraction procedures and nineteen cases were treated with techniques which incorporated extraction of four premolars in each patient. The ages ranged from 10 to 14 years at the start of treatment.

Angular and linear changes were recorded for many of the dental and skeletal structures. Mean values, standard deviations and probability values were calculated for all changes measured.

Conclusions From Statistical Analysis

1. The effect of orthodontic treatment continues for some time after the treatment appliances are removed.

2. The forward progress of mandibular structures surpasses the forward progress of Point A (Downs) during treatment and retention.

3. The forward progress of Point A (Downs) is restricted more in the cases treated with extraction than in the nonextraction cases.

4. The occlusal plane is tipped upward at the posterior during treatment and to a greater degree in the nonextraction cases. The occlusal plane angle approaches its original value during retention.

5. The "tip back" of the maxillary and mandibular first molars during treatment of the nonextraction cases tended to recover and approach their original respective angulations during retention.

6. Mandibular growth contributes to the forward positioning of the mandibular first molar in both nonextraction and extraction treatment, referring to the 10- to 14-year-old age group.

7. The anteroposterior apical base difference of maxilla and mandible is reduced more in the treatment of extraction cases and may be increased in the nonextraction cases when treatment results in a disproportionate increase in dental height over facial height.

8. The facial-skeletal pattern can be changed due to the effect of orthodontic treatment if growth occurs with treatment.

(Additional abstracts presented before the Research Section of the American Association of Orthodontists in May, 1955, will appear from time to time in forthcoming issues of the Journal.)

News and Notes

1956 Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry or associated with it as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art and science of orthodontics.

Prize.—A cash prize of $500.00 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced with at least 1 inch margins. Each sheet must be numbered and bound or assembled with paper fasteners in a "brief cover" for easy handling. Three complete copies of each essay, including all illustrations, tables, and bibliography, must be submitted. The name and address of the author must not appear in the essay. For purpose of identification, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a separate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held at the Statler Hotel, Boston, Massachusetts, the week of April 29, 1956.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate on or before Jan. 10, 1956, by Dr. Thomas D. Speidel, University of Minnesota, School of Dentistry, Minneapolis 14, Minnesota.

H. I. Margolis, Chairman, Research Committee
American Association of Orthodontists
311 Commonwealth Ave.
Boston 15, Massachusetts

American Association of Orthodontists, 1956 Research Section Meeting

Continuing the policy of recent years, the program will consist of a series of ten-minute research reports which may be presented orally or read by title only. All persons engaged in research are urged to participate in this program, which will be held on April 29 and 30 and May 1 and 2, 1956, in the Statler Hotel, Boston, Massachusetts.

Each participant is asked to prepare a 250-word abstract for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Abstract for publication and the ten-minute oral presentation at the meeting should be carefully prepared to present an adequate description of the import of your investigation.

Forms for use in submitting the title and 250-word abstract of your research will be sent to each dental school orthodontic department and to any individual requesting one. Please send your title and abstract as early as possible, but not later than Jan. 10, 1956, to Dr. J. William Adams, 707 Bankers Trust Bldg., Indianapolis 4, Indiana.

H. I. Margolis, Chairman, Research Committee
American Association of Orthodontists
311 Commonwealth Ave.
Boston 15, Massachusetts

American Association of Orthodontists

The results of nominations and elections at the A. A. O. meeting in San Francisco, California, May, 1955, are as follows:

President, Franklin A. Squires, White Plains, New York.
Vice-President, William B. Stevenson, Sr., Amarillo, Texas.
Secretary-Treasurer, Earl E. Shepard, St. Louis, Missouri.
Librarian, Charles R. Baker, Evanston, Illinois.
Historian, Leuman M. Waugh, New York, New York.
Budget Committee, George H. Siersma (for three years).
Herbert V. Muchnic (for two years as a replacement for the late Vernon Hunt).

Leigh C. Fairbank, Washington, D. C., was elected a member of the Publication and Editorial Board. Frank P. Bowyer, Knoxville, Tennessee, was elected a member of the Public Relations Committee. Other committee appointments were as follows:

Educational Committee: Robert E. Moyers, Ann Arbor, Michigan (for three years).
Research Committee: William Downs, Chicago, Illinois (for five years).
Judicial Council: William Giblin, Montclair, New Jersey (for three years).
Constitution and By-Laws Committee: Donald MacEwan, Seattle, Washington (for three years).
Relief Committee: Eugene West, San Francisco, California (for three years).
Law Infractions Committee: John R. McCoy, Los Angeles, California (for five years).
(To replace the late Dr. Pugh): William H. Oliver, Nashville, Tennessee (for one year).
Military Affairs Committee: Robert Swinehart, Baltimore, Maryland (for five years).
Hugh Sims, Tulsa, Oklahoma (for the unexpired term of the late Dr. MacConkey).
Public Health Committee: J. A. Salzmann, New York, New York (for five years).
Convention and Planning Committee: Edwin Erickson, Washington, D. C. (for five years).
Director of the American Board of Orthodontics: J. A. Salzmann, New York, New York (for seven years).

American Board of Orthodontics

Members certified at the last meeting of the American Board of Orthodontics in 1954 were:

California:

Earl R. Crane, San Bernardino.
William S. Parker, Sacramento.
Robert L. Whitney, Pasadena.

Delaware:

Louis Kreshtool, Wilmington.

District of Columbia:

William D. Curtis, Washington.

Florida:

Harold K. Terry, Fort Lauderdale.

Illinois:

T. M. Graber, Chicago.
James J. Guerrero, Chicago.

Indiana:

Morris M. Stoner, Indianapolis.

Missouri:

Leo B. Lundergan, St. Louis.
Earl E. Shepard, St. Louis.
Harold E. Thompson, Kansas City.

New Jersey:

Sidney Brandt, Morristown.
Leonard T. Campi, Asbury Park.
H. Milton Cooper, Hackensack.
Gerard A. Devlin, Newark.
C. Douglas Hoyt, Fair Haven.

New York:

Robert M. Cole, Tarrytown.
Herbert S. Fine, Mt. Vernon.
Abraham I. Fingeroth, New Rochelle.
Robert C. Germond, Jamestown.
Maurice M. Gershater, White Plains.
Burton A. Hoffman, Buffalo.
Joseph Luban, Yonkers.
Walter G. Spengeman, Yonkers.

Oregon:

Guy A. Woods, Jr., Portland.

Pennsylvania:

Harry B. Wright, Philadelphia.

Tennessee:

Doyle J. Smith, Memphis.

Texas:

Solon P. Crain, Odessa.

Washington:

Herman Dahl, Tacoma.
William P. McGovern, Tacoma.

Canada:

Harold E. Leslie, Toronto, Ontario.

A. B. O. Theses Available for Reading on Constituent Society Programs

Reading of A. B. O. theses by diplomates before constituent societies has been disallowed for the past several years. This stand was taken because of serious abuses encountered.

Year after year a desire for use of these theses by constituent societies had increased to the point where the American Board of Orthodontics undertook a serious attempt to make some of them available, while at the same time protecting our profession by enactment of rigid controls aimed at prohibiting the abuses.

In 1953 the Board created a pool of theses available for reading before constituent societies, should they be desired. At the present time thirty-four theses are in this pool, from the 1953, 1954, and 1955 examinations.

Rules for using these theses are as follows:

1. Permission for inclusion on programs must be requested in writing by the secretary of the constituent society and filed with the secretary of the American Board of Orthodontics.
2. The constituent societies must not offer the paper for publication in any journal without express written permission from the Board.
3. Should permission be given for publication, no reprints will be permitted under any circumstances.
4. The author of the thesis is required to announce that the paper was given in partial fulfillment of his A. B. O. requirements, that the Board has granted permission for the presentation, and that such permission does not necessarily imply that the Board is in agreement with the concepts expressed in the thesis.

CONSTITUENT SOCIETY POOL OF THESES
1955-1956

Author	*Title*
Murray L. Ballard	A Fifth Column Within Normal Dental Occlusions
Harold S. Born	Some Facts Concerning the Open Coil Spring
C. W. Carey	Laminated Arches—The Double Ribbon and Double Edgewise
William B. Downs	Analysis of the Dentofacial Profile
Maxwell S. Fogel	A Cephalometric Assessment of Prepared Mandibular Anchorage
Reed A. Holdaway	Changes in Relationship of Points A and B During Orthodontic Treatment
Frank Kanter	Mandibular Anchorage and Extraoral Force
Alton W. Moore	Orthodontic Treatment Factors in Class II Malocclusion
Earl W. Renfroe	The Factor of Stabilization in Anchorage

Central Section of the American Society of Orthodontists

The eighteenth annual session of the Central Section of the American Association of Orthodontists will be held in Des Moines, Iowa, at the Savery Hotel, Oct. 3 and 4, 1955. This is the first time that the Central Section has held a meeting in Des Moines and the second time in Iowa. It goes without saying that the host city and the whole state of Iowa are leaving no stone unturned to make this one of the most enjoyable meetings in the annals of our section. Dr. James S. Hoffer, chairman of the Local Arrangements Committee, is being assisted by the entire corps of Des Moines orthodontists.

To Drs. William B. Downs, B. F. Dewel, and W. W. Winter has been assigned the task of preparing the scientific essay program.

Dr. Elmer Bay has accepted the chairmanship of the Table Clinic Program Committee. His committee is hard at work enlisting your help in making this year's table clinic the best ever. Please heed their invitation to present your "pet project."

The officers and all the committees of the Central Section are anxious to have a record attendance in Des Moines. We are all looking forward to seeing you.

HOWARD YOST, President

Great Lakes Society of Orthodontists

The 1955 annual meeting of the Great Lakes Society of Orthodontists will be held at Columbus, Ohio, Oct. 30 through Nov. 2, 1955. All activities will be held at the Neil House in Columbus.

Middle Atlantic Society of Orthodontists

The Middle Atlantic Society of Orthodontists will hold its next annual meeting Oct. 5, 6, and 7, 1955, at the Shoreham Hotel in Washington, D. C.

Northeastern Society of Orthodontists

The next meeting of the Northeastern Society of Orthodontists will be held Monday and Tuesday, Oct. 24 and 25, 1955, at the Hotel Commodore in New York City.

Pacific Coast Society of Orthodontists

OFFICERS AND COMMITTEES

President, Arnold E. Stoller, Seattle, Washington.

President-Elect, A. Frank Heimlich, Santa Barbara, California.

Vice-President, Richard M. Railsback, Oakland, California.

Secretary-Treasurer, Raymond M. Curtner, San Francisco, California.

Membership is 272.

The Northern Component meets on the second Tuesday of March, June, September, and December.

The Central Component meets on the second Tuesday of March, June, September, and December.

The Southern Component meets on the second Friday of March, June, September, and December.

NOTES FROM THE PRESIDENT

The fifty-first annual session of the American Society of Orthodontists in San Francisco was undoubtedly the most outstanding meeting the A. A. O. ever held. The members of the P.C.S.O. are indebted to Fred West for a magnificent job. He surrounded himself with men who *worked* and every phase of this meeting progressed smoothly and efficiently. The planning and timing of every clinic, program, social event, board meeting, and business session was a symphony in coordination. It is needless to say that we appreciated the efforts expended and humbly say "thank you" to all who participated.

The Pacific Coast Society is sorry to report the deaths of nine of its members during the past year:

Howard Dunn, Oakland, California.
John Mason Griffin, Hollywood, California.
Vice-President Vernon L. Hunt, Eureka, California.
Sherman Maxon, Walla Walla, Washington.
Past President Ben L. Reese, Los Angeles, California.
J. Robert Smith, San Diego, California.
Gene Springer, Santa Barbara, California.
Past President Allen L. Suggett, Santa Barbara, California.
Albert E. Voss, Los Angeles, California.

INVITATION TO SEATTLE

Seattle will be the official host for the next Pacific Coast meeting to be held Aug. 13-15, 1956. We urge you to start thinking about it. This will be our first experience as hosts to a Pacific Coast meeting, and we will try very hard to see that you have an excellent program and a lot of fun too.

Southern Society of Orthodontists

The Southern Society of Orthodontists will meet in Charlotte, North Carolina, Sept. 25 to 28, 1955.

Southwestern Society of Orthodontists

The next meeting of the Southwestern Society of Orthodontists will be held in Wichita, Kansas, at the Broadview Hotel, Oct. 16 through 19, 1955.

Fifteenth Annual Research Award Competition
Chicago Dental Society

The Chicago Dental Society offers an annual prize of $500.00 for the most meritorious essay of an original investigation containing *new and significant* material of value to dentistry.

Eligibility.—The competition is open to any member of the American Dental Association, a recognized foreign dental society, student, or other person of scientific attainment affiliated with a recognized institution in the field of dentistry.

Presentation.—The author of the winning essay will be invited to present it at the ninety-first midwinter meeting of the Chicago Society in Chicago, Feb. 5 to 8, 1956.

Application.—Application to enter competition must be filed in the office of the Society before Sept. 1, 1955. This form, as well as complete contest rules, may be secured by writing the Chicago Dental Society, 30 North Michigan Ave., Chicago 2, Illinois.

Closing Date.—Manuscripts of all essays must be received not later than Oct. 1, 1955.

The Chicago Dental Society reserves the right to omit the award if, in the judgment of the Award Committee, none of the entries is worthy.

Dental Laboratory Code

According to a recent press release from the National Association of Dental Laboratories, final approval by the Federal Trade Commission of the Code of Fair Practices for the dental laboratory industry is expected before October 1.

Among other things contained in the release is the observation that at the request of Bernard Beazley, secretary of the Council on Dental Trade and Laboratory Relations, the American Dental Association was given permission to prepare and present, within a reasonable time, a memorandum from deans of dental colleges setting forth their concepts of the definition of design. Permission was also granted the American Association of Orthodontists, at the request of Attorney John McCune, to prepare a similar brief for the orthodontists.

All suggestions and requests are being considered by the commission now and their decision will be reflected in the Code which is finally approved by FTC.

Copies of Journal Needed

The following copies are needed by the Department of Orthodontics of the School of Dentistry, the University of North Carolina, to complete their file of the AMERICAN JOURNAL OF ORTHODONTICS:

1922 through 1926, the INTERNATIONAL JOURNAL OF ORTHODONTICS

1922—February and July.
1923—January, February, and March.
1924—December.
1925—January, February, March, May, June, July, October, and November.
1926—February.

1946—AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY

1946—April.

The University will gladly accept these issues as a donation, or will pay the publisher's established rate of $1.10 for single copies.

Write: Dr. L. B. Higley, Director, Department of Orthodontics, School of Dentistry, the University of North Carolina, Chapel Hill, North Carolina.

Notes of Interest

Robert D. Andrews, D.D.S., announces his return from active duty with the Armed Forces and the reopening of his office at 15442 Ventura Blvd., Sherman Oaks, California, practice limited to orthodontics.

Victor Dovitch, D.D.S., announces the opening of his office for the practice of orthodontics at 13508 Ventura Blvd., Sherman Oaks, California.

Dr. Nathan G. Gaston announces the association of Dr. Billie G. West, practice limited to orthodontics, Bernhardt Bldg., Monroe, Louisiana.

Drs. E. C. King and R. W. Baker announce the opening of an office in the Dental Arts Bldg., Cortland, New York, practice limited to orthodontics.

Dr. Robert M. Perry wishes to announce the opening of his office at 611 Greyhound Bldg., Calgary, Canada, practice limited to orthodontics.

Earl E. Shepard, D.D.S., announces the association of James M. Jolly, D.D.S., M.S., 8230 Forsyth Blvd., St. Louis 24, Missouri, practice limited to orthodontics.

W. G. Schmidt, D.D.S., announces the opening of his office at 220 S. E. 7th St., Evansville, Indiana, for the practice of orthodontics.

James T. Tonery, D.D.S., announces the opening of his office at 618 Temple Bldg., Rochester, New York, practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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